

Counter Biology

DIYbio is a national organization founded in 2008 to use the tools of synthetic biology to expand experimentation and bioengineering into the realm of hobbyists. Daniel Grushkin of the NYC chapter elaborates on their belief that academic labs have limited ability to explore the potentials of scientific discoveries.

Daniel Grushkin interviewed by Elizabeth Krasner

Elizabeth Krasner Calling yourselves DIY seems like an extension of the 1960s and *Whole Earth* 'access to tools' mantra. You work without the standard equipment found in a biology lab and in fact, much (if not all) of your work is done at home, in kitchens and living rooms. How do you adapt biological experiments to work outside the lab?

Daniel Grushkin We see ourselves rooted in two movements. The first is Silicon Valley's Homebrew Computer Club. The group, which eventually gave rise to personal computing, was highly influenced by the 60s' mantras. But we also see ourselves indebted to the growth of hacker spaces. DIYbio found its start in our kitchens and living rooms. But as we've organized, we've begun to build labs that unlike conventional spaces, are open to collaboration.

We're not averse to working with institutions; in fact, many of our members work in universities by day. But corporate institutions are beholden to profits and university labs are beholden to grants. DIYers are beholden to neither, and that allows us to work on projects that are a little more speculative.

EK What do you see as the role of biology? What's the future of biotech?

DG Biotech is already involved in every part of our lives – all the way up from the food we eat. At this point, lines can't be drawn. We are biology.

EK You straddle the line between an anti-institutional organization, necessarily amateur and independent, and working at the forefront of one of the most important new technologies – biotech. Do you see yourselves as 'biohackers', a term used by one of your members?

DG I think it's a silly term. Any genetic engineer is and is not a biohacker. When a computer hacker hacks into program, he swerves the system from its original designer's intent. But who's the original designer of life? And what's his intent? I think of biotech as a new design palette. We'll only understand our work's 'philosophical' meaning as we proceed.

EK You speak about your practice as feeling transgressive. What is your relationship with the law, or the FBI?

DG The laws around working with biology are gray. In order to avert a wrongful investigation – see Steve Kurtz¹ – the NYC DIYbio community has met with our local Weapons of Mass Destruction Coordinator – that's really his title – and engaged in dialogue. We have less clout than universities and more to lose.

Our group is committed to safety. We have strict rules: we will never work with anything that is pathogenic and we will never work with anything that steps beyond the Centers for Disease Control specifications for biosafety level one. We are constantly in discussion, but our basic code is: do no harm, abide by all regulations (of which there are few), and conduct work in a safe manner. We battle against the perception that our work is dangerous. One of the most ridiculous claims was that a group like ours might coax *E. coli* into making cocaine. Given that the world's premiere lab has been spending millions to coax bacteria into producing artemisinin (an anti-malarial) for nearly a decade, the claim that amateurs might design a drug cartel is preposterous.

EK Amateur bioengineers have come under fire in the last couple of years. Scientifically, how close is the work that you are doing to bioterrorism?

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The extracted DNA material is located in the cloud above the strawberry liquid. Mixed and photographed by Cameron Woods Robertson.



DG Technically speaking, it's a question of intention. The fears over bioterrorism are overblown; the level of sophistication to produce a novel pathogen is so great, and the odds of creating it by accident are infinitesimally small. The last successful bioterrorist took anthrax from government labs where he had top security clearance.

EK What's your dream project?

DG I'd like to build a storefront where students can come during the day to work on synthetic biology. After hours, the space would be an incubator for amateurs to engineer organisms the world has yet to see. Surprisingly, we're almost there. Our DIY Lab in Brooklyn should be open by the time this interview is in print.

EK What is your end goal? To further technology? To influence policy?

DG To make stuff.

¹ Steve Kurtz, a 'bioartist' and professor at SUNY Buffalo, was detained for 22 hours on suspicions of bioterrorism when police found petri dishes with biological specimens – part of an installation at the Massachusetts Museum of Contemporary Art – in his apartment when Kurtz called them to report the death of his wife in 2004. The samples were deemed safe, and Kurtz was sent home after one week in jail.

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Bio Mixology

Recipe for strawberry DNA extraction

Grushkin shares with us DIYbio's recipe for strawberry DNA with assurances that 'if all the strawberries on earth were wiped out, you could recreate them with this formula, just like in Jurassic Park but without the bloodshed'. It can also be used to test for the presence of a specific engineered DNA sequence, such as the uniquely pesticide-tolerant gene Roundup Ready.

Ingredients

rubbing alcohol
1/2 teaspoon salt
1/3 cup water
1 tablespoon liquid dishwashing detergent
glass or small bowl
coffee filter
tall drinking glass (test tube, shot glass or champagne flute)
3 ripe strawberries (tops removed)
recloseable plastic sandwich bag
bamboo skewer or kabob sticks

- 1 Chill the rubbing alcohol in the freezer. (You'll need it later.)
- 2 Mix the salt, water, and detergent in a glass or small bowl. Set the mixture aside. This is your extraction liquid.
- 3 Put the strawberries in the plastic bag and push out all the extra air. Seal it tightly. With your fingers or a tenderizer, smash the strawberry mixture for two minutes.
- 4 Add 3 tablespoons of the extraction liquid you made in Step 2 to the strawberries in the bag. Push out all the extra air and reseal the bag.
- 5 Squeeze the strawberry mixture with your fingers for one minute.
- 6 Pour the strawberry mixture from the bag into a coffee filter. Let it drip into the glass until there is no liquid left in the funnel.
- 7 Throw away the filter and the strawberry pulp inside. Pour the contents of the glass into the test tube, shot glass or champagne flute until it is 1/4 full.
- 8 Tilt the test tube or glass and very slowly pour cold rubbing alcohol down the side until the mixture is about half and half. The alcohol should form a layer on top of the strawberry liquid. Wait about one minute. (Don't let the alcohol and strawberry liquid mix. The DNA collects between the two layers.)
- 9 Dip the skewer into the glass where the alcohol and strawberry layers meet. Pull up the skewer. The whitish, stringy strand that emerges is DNA containing strawberry genes.