

Final Report on the 2021 DIY Biology Community Survey

DIY Biology: A Global Survey on Democratizing Science

Conducted and Summarized by Anna Verena Eireiner

About the 2021 DIY Biology Community Survey

This survey was conducted with three main goals in mind: First, I wanted to draw some comparisons between the first quantitative survey on DIY biology which was conducted by researchers at the US-based Wilson Centre (Grushkin et al., 2013). The survey is an oft-cited point of reference in the literature on DIY biology, public discourses, and policymaking. The underlying assumption was that in the years since the 2013 survey was conducted, DIY biology, as a relatively young movement, has evolved, with many new community laboratories opening around the world. Second, I wanted to learn more about how DIY biology relates to traditional scientific institutions and about the degree of professionalisation/expertise within the communities. These aspects are key to the concept of extra-institutional science but have not been covered in previous studies. Third, I wanted to provide DIY biology organisers and policymakers with current, updated data on DIY biology.

The survey ran between March and November 2021. The survey was designed with two focal points in mind. First, I decided to include some items from the Grushkin et al. (2013) survey as a point of comparison. I communicated with the authors of the Grushkin et al. (2013) paper to gain their insights in the process. Second, I designed new items to explore DIY biology's relationship with industry and academia. This turned out to be a balancing act, as I also had to keep the survey to a reasonable length to hold participants' attention. In the end, I decided on a survey design that includes four sections with a total of 28 items.

The first section focuses on demographic questions, such as age and education history and closely resembles questions in the Grushkin et al. (2013) survey. This set of questions resembles but are not identical to the 2013 survey. This is to say that items do not yield directly comparable results, such as the question of DIY biologists' gender identification. Instead of using Grushkin's (2013) binary (i.e. female/male) answer options, I incorporated a more inclusive approach (i.e. female/male/non-binary, third gender/prefer not to say/skip question).

The second section asks about previous or current experiences in industry and academia. The third section focuses on participants' activities in DIY biology, such as their projects and lab set-up. The final set of questions asks about participants' opinions on DIY biology's openness and safety. The 28 questions include multiple choice, text entry for short and short open-ended responses. One of the items consisted of constant sums to indicate typical weekly hours allocated to different DIY activities.

I used the Qualtrics survey software for implementation, distribution, data collection and some of the data analysis process. I used various social media platforms, namely Twitter, Facebook and Slack, as well as DIY biology-specific e-mail-lists and meet-up groups to distribute the survey. A total of 154 individuals responded to the survey. Two participants only completed the first question, which is why their responses were not included in the final dataset. 30 participants partially completed the survey by answering at least two questions. 124 participants completed the whole survey.

Estimates on the total number of DIY biologists around the world vary. The most popular DIYbio Google group that communities' members use to exchange information has ≥5100 members as of 2022 (DIYbio Google Group, 2022). The survey data does not represent an unbiased reflection of the diverse, global DIY biology communities and should therefore not be generalized. The survey does, however, provide compelling perspectives on the state of the DIY biology community. Moreover, the survey explores some themes that have thus far not received ample attention, such as DIY biology's relationship with academia and industry.

Every individual that self-identified as a DIY biologist was invited to take part in the survey. All participants were volunteers. Participants were instructed that the survey is part of a research project that seeks to study how the DIY biology movement has evolved in recent years. Participation was incentivized via a raffle valued at US\$230 in total. The three voucher winners were picked using a random number generator. The main reason for giving an incentive was the length of the survey (28 items), which required participants to invest a significant amount of their time (median time of completion: 20 minutes).

Prior to the start of the survey, participants were presented with an informed consent statement, which included information on the purpose of the study, duration, and risks. If participants indicated their consent, they were then presented with twenty-eight questions. At the end of the survey, participants indicated their interest in a follow-up interview and participation in the survey's raffle. A concluding section asked for feedback and comments.

I filtered, classified, merged, and cleaned the survey data using Qualtrics. I then exported and visualized the data. Survey participants often choose to thoughtfully share their detailed perspectives in free-text responses. These free-text essays proved to be a great resource, which is why they are included in this paper.

DIY biology members reached out to me with their feedback and support in the process of designing this survey, during the phase of its distribution and after its completion, which I found very helpful. Many community members communicated to me that they were interested in the survey data. This is why I decided to disseminate my research findings to past study participants and communities-at-large. Thus, I presented the first 2021 DIY Biology Community Survey results in an online panel at an important global community event, the Global Community Summit 2021.

See also:

Grushkin, D., Kuiken, T., & Millet, P. (2013). Seven myths and realities about Do-It-Yourself Biology. SYN BIO 5. Woodrow Wilson Center. <https://www.wilsoncenter.org/publication/seven-myths-and-realities-about-do-it-yourself-biology-0>

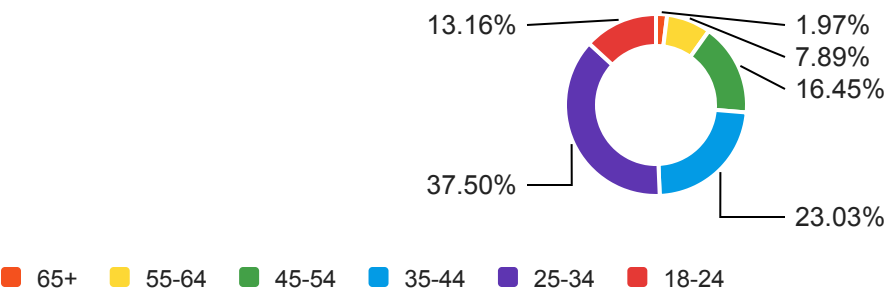
Q1 - What is your gender?

152 Responses



Field	Choice Count
M	93
F	49
NB	4
NA	6
Total	152

Q2 - What is your age?



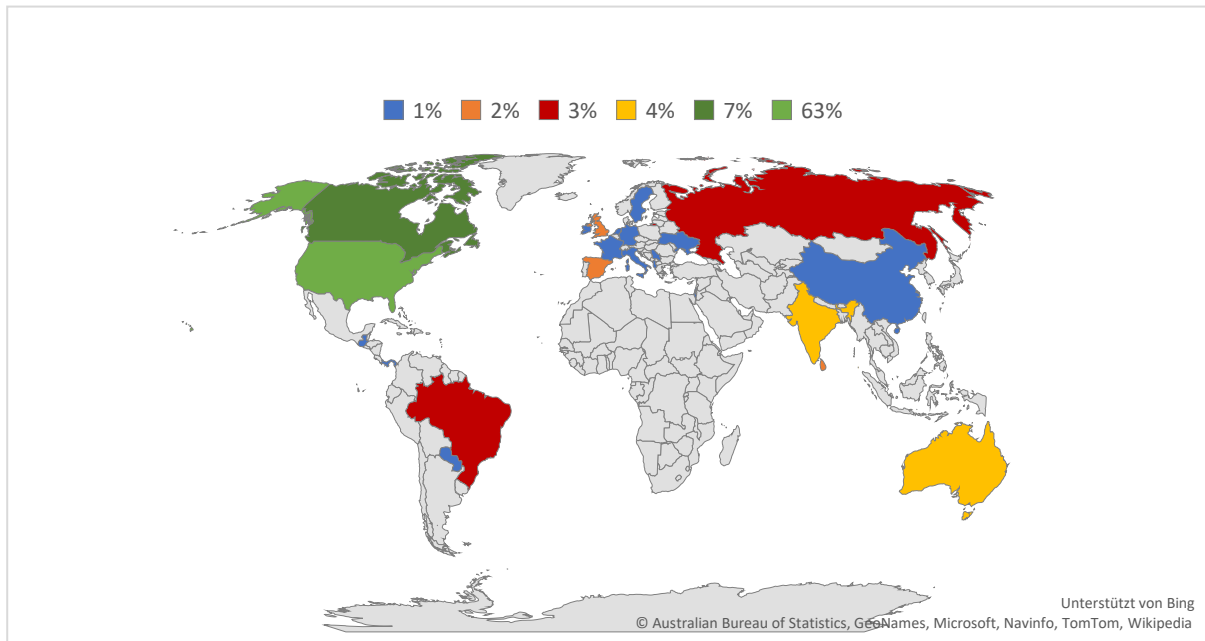
Q2 - What is your age?

Field	Min	Max	Mean	Standard Deviation	Variance	Responses	Sum
What is your age?	1.00	6.00	2.74	1.22	1.49	152	417.00

152 Responses

Field	Choice Count
18-24	20
25-34	57
35-44	35
45-54	25
55-64	12
65+	3
Total	152

Q3/4: In which country do you currently reside?



A total of **152 participants** indicated their country of residence, representing **31 different countries** across both the **Global North and Global South**. While some countries were represented by only a small number of respondents, the data reflects the **international scope of the DIY biology community**.

The **largest proportion of respondents (57%)** currently reside in the **United States**, which is often considered the birthplace of the DIY biology movement and home to one of the largest concentrations of community laboratories. The second, third, and fourth most represented countries were **Canada (7%)**, the **United Kingdom (4%)**, and **India (3%)**. **Brazil (3%)** and **Russia (2%)** also had notable participation.

Smaller numbers of respondents reported living in **Germany, the Netherlands, and Australia (each around 2%)**, followed by **Spain, Sri Lanka, and Argentina (each 1%)**. An additional **13% of respondents** came from a diverse range of countries, including **Albania, Armenia, China, Colombia, Côte d'Ivoire, Egypt, France, Guatemala, Hong Kong, Ireland, Israel, Italy, Mexico, Panama, Paraguay, the Philippines, Serbia, Sweden, Ukraine, and Vietnam**, each representing less than 1% of the total sample.

These results highlight the **global reach of DIY biology**, with participants from a wide array of national and cultural backgrounds contributing to the movement.

Q5 - What is the highest level of education you have completed?

151 Responses

Field	Choice Count
Some High School	2
High School	5
Some College	8
Associate's Degree	3
Bachelors-level Degree	43
Some graduate school	10
MA/MS Degre	41
PhD or similar	20
Postdoc	14
Trade school	0
NA	1
Other (please specify):	4
Total	151

3 Responses

Other (please specify): - Text

5 years college

GED

multiple answers

Q6 - If you have completed, or are currently completing, an academic degree, what describes your main field of study best?

144 Responses

Field	Choice Count
Bio	37
Chemistry	3
Physics	6
Earth or Space Sciences	4
Natural Sciences: other	7
Formal Sciences	9
Applied Sciences	23
Social Sciences	11
Humanities	5
Other (please specify)	23

Natural Sciences: other (please specify) - Text

Biochemistry

psychology

general science

Public Health

Biophysics

22 Responses

Other (please specify): - Text

bioinformatics

Biomedical engineering

Design

design

Forestry

psychology

Education

Design

Studio Art

Design

Engeneering industrial

Biomedicine -disease

industrial design

no degree

Painting

International Relations

No degree

Art Design

No degree

no degree

MBA

Education Science, Biology, Chemistry, Bioinformatics, Statistics, Theoretical Physics (Chaos & Network Theory, Soft Matter Physics), Ethics & Tech Philosophy

Q7 - What profession from the following list best describes you?

148 Responses

Field	Choice Count
Sports & Athletics	0
Installation, Construction, Maintenance & Repair	0
Sales	1
Farming, Fishing & Forestry	1
Prefer not to say	1
Community & Social Service	2
Legal	3
Entertainment & Media	4
Office & Administrative Support	4
Architecture & Engineering	6
Business & Financial Operations	6
Mathematics & Computing	8
Education & Training	8
Arts & Design	10
Healthcare & Medical Devices	13
Other (please specify):	20
Biotechnology	61

Other (please specify): - Text

19 Responses

Other (please specify): - Text

Product engineer

Environmental services and conservation

Research

Public engagement consultant

Microbiology

government

Retired

Brain Health Professional

Microbiology

none

Entrepreneur

Beer

Information Technology

Oil and gas

Biohacking

everything except sports, and business, and legal, and entertainment

multiple? I am a science professor at an art school?

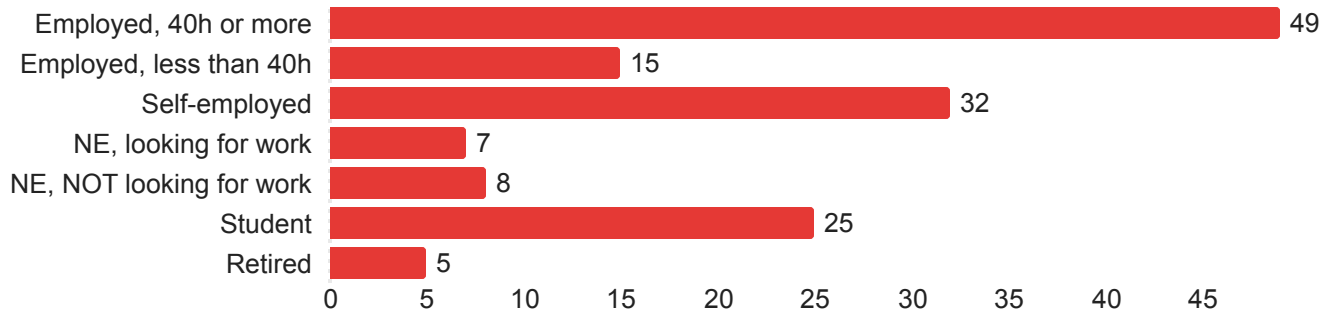
equally Biotech, IT-Sec and critical tech assessment

researcher at a think tank

Select a field

Q8 - What is your employment status?

148 Responses



148 Responses

Field	Choice Count
Employed, 40h or more	49
Employed, less than 40h	15
Self-employed	32
Not employed, looking for work	7
Not employed, NOT looking for work	8
Student	25
Retired	5
NA	3
Other (please specify):	4
Total	148

4 Responses

Other (please specify): - Text

Self employed with little paid work

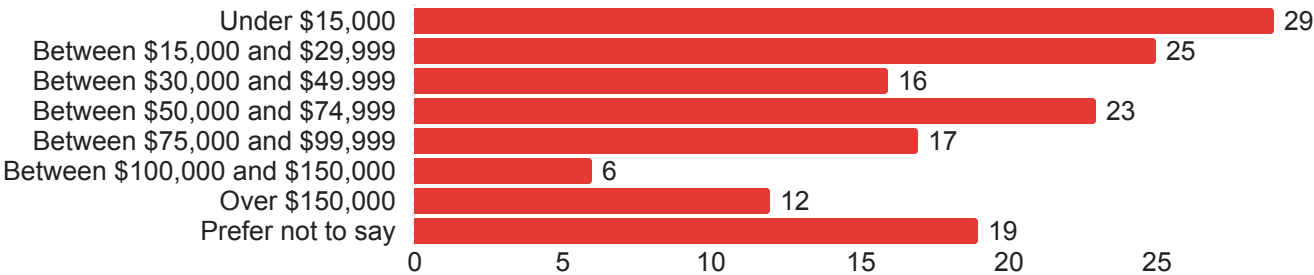
Entrepreneur, full time

full-time employed and student

Student & employed

Q9 - What is your annual income?

147 Responses

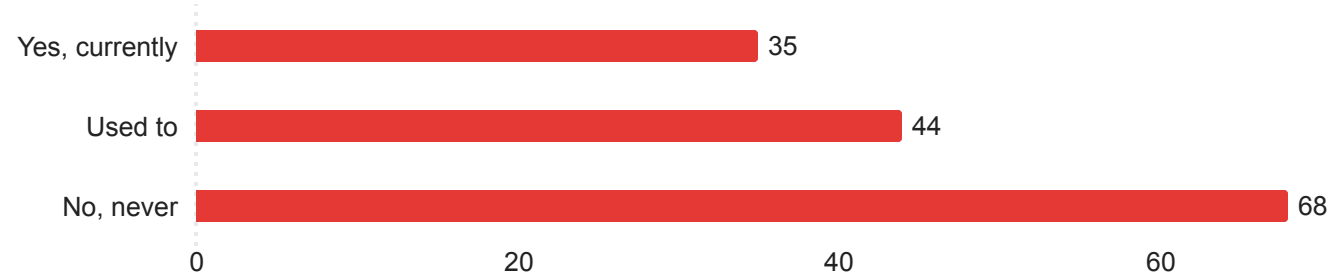


147 Responses

Field	Choice Count
Under \$15,000	29
Between \$15,000 and \$29,999	25
Between \$30,000 and \$49,999	16
Between \$50,000 and \$74,999	23
Between \$75,000 and \$99,999	17
Between \$100,000 and \$150,000	6
Over \$150,000	12
Prefer not to say	19
Total	147

Q10 - Are you currently, or have you ever been, employed in academia?

147 Responses



147 Responses

Field	Choice Count
Yes, currently	35
Used to	44
No, never	68
Total	147

Q11 - What best matches your current or last academic job title?

78 Responses

Field	Choice Count
Research Assistant (RA)	25
Grad Student	16
Postdoctoral Research/Fellow/Scholar	8
Research Associate/Scientist/Fellow	11
Lecturer/Instructor	5
Adjunct Prof	1
Assistant/Associate Prof	3
Full Prof	1
NA	1
other	7
Total	78

7 Responses

Other (please specify): - Text

Laboratory technician

Teaching Assistant

Creative Director, contracted

clinical research coordinator

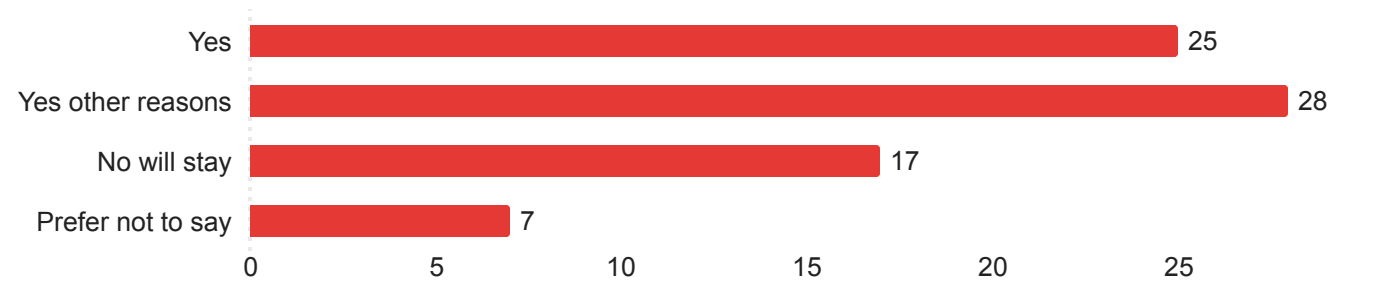
the guy who wanders around and fixes other people's stuff

Lab Assistant (Work-Study)

laboratory technician

Q12 - Did you ever, or are you currently, thinking about leaving academia to work in DIY biology full time?

77 Responses



Field	Min	Max	Mean	Standard Deviation	Variance	Responses
Did you ever, or are you currently, thinking about leaving academia to work in DIY biology full time?	1	4	2	1	1	77

Field	Choice Count
Yes	25
Yes other reasons	28
No will stay	17
Prefer not to say	7
Total	77

Q13 - Why would you rather work in DIY biology than in academia?

21 Responses

Why would you rather work in DIY biology than in academia?

My goal is solving the worlds problems and DIY biology is the fastest route.

The freedom of exploration, the freedom to choose new, or many research projects, not being bound by the pressures of publish or perish, not being forced to do boring research just for a publication, being able to chart new directions instead of being bound by the history of the institution and the PI's that came before. Being able to pursue pure science out of curiosity.

More inclusive and equitable environment

corruption, mobbing, bullying, financially motivated publications, theft of ideas, totalitarianism from the leadership of scientific journalists and no openness to candidates, violation in the methodology of recording experiments, falsification of results, and much more that turned the world's science into a stinking farce.

my education level does not let me be a researching professor but I can do research as a DIY biologist

Freedom to make stuff that directly contributed to the society. No "publish or perish pressure".

I kinda work in both. I work in academia 1/2 time and the rest I work in entrepreneurship in sciences

No lords no masters. Freedom to work on what is important. Ability to make everything openly licensed without university owning patents. Not having to keep research secret until publication. No pressure to publish in non-open journals.

Pure science is not based on academia, it is based on great scientist.
I don't like to feel pressure and my tempo is different than in academy.

Exploration, more scientific freedom, more profession freedom, instead of being boxed into an extremely limited role due to the lack of a PhD and only working on a tiny repetitive portion of someone else's project which I am not allowed to change or investigate new aspects of. DIY Biology is free of such constraints as being required to pursue only the flashiest publication worthy experiments and working overtime hours without overtime pay to keep doing something so mundane that might not see any payout until a few years and post-doc's later. Who knows if this is working? Who knows why it's not working? Who is this even benefitting? Just the author? DIY Biology gives us the freedom to pursue science as a passion project. Not for the flashy news articles, nor the prestige. DIY Biology is bringing science back to it's roots of exploration and answering personal questions and learning more along the way. I don't need to be an expert in the field with multiple degrees to try a simple experiment in that field. I can learn it as I go. And maybe I'll learn or create an entirely new approach that hasn't been done in academia before because of their traditional methods and constraints. I can contribute to a project because I'm passionate about it. Not because I'm forced to play interoffice politics and pretend to be nice and do favors for someone else who wants to use me for their new publication.

Academia increasingly operates as a business rather than as a knowledge generator. Interdisciplinary perspectives are undervalued in academia.

DIY bio is a field that can be self-defining in terms of goals, projects and collaborations. It's aimed towards knowledge sharing and facilitating cooperation.

In Taiwan R.O.C, the research field I had have ever seen was so corrupt and so faked by artificial relationship, in fact, they can not do any science progress development!

Academia presents a range of frustrations, namely, it is very out of touch with the communities that it purports to serve. In my time in academia I have grown disillusioned with the whole operation as I have witnessed administrators make decisions that clearly prioritize financial interests over strong science and supporting/ diversifying their workforce. Additionally, many in academia appear to only work to service their own egos, which is not conducive to good science or a healthy workplace.

You can work in many areas at the same time and learn new things permanently, they do not require you to have a single area of expertise and it opens your mind to create, innovate and do new things.

Freedom

I'm The best one I'm creative and I want the flexibility to do what I want to do and work with the people I want to work with. I like environments where I want to flex interdisciplinary skills. I like both actually, this question isn't worded well.

Democratizing biological technologies is what I get most excited about

More freedom!

Always level up!

Knowledge is a set of tools used on problems. Academia shows the science of the tools and a little of its application or philosophy. DIY biology is about solving questions and acquiring tools for that purpose. Added the innovations that will solve major world problems will not happen in a vacuum (island), but as a labor of love in a garage/home lab.

I would, but it is not financially viable, unfortunately.

Q14 - Why would you rather stay in academia than work in DIY biology full time?

17 Responses

Why would you rather stay in academia than work in DIY biology full time?

To obtain my PhD

Academia will bring up the local problems that students are facing in academic life

I can do both at the same time because I study the learning affordances of DIY biology. In other words, my purpose is at the intersection not in academia or DIY biology in isolation

Each has it's own goals and tasks and it's own value. My DIY projects cover other topics I find useful for society that are not covered by academia science

While the career path in academia isn't necessarily a straight one there's more of a path there than there is in DIY Bio.

I work in DIY biology while in Academia

Planning on leaving academia for industry once I finish the PhD. Need money, can't do DIY bio full time if it doesn't make money.

I like my job, teaching is my passion

I like to continuously have the experience of teaching and mentoring students and collaborating with other institutions. In Sri Lanka, it is hard to get that experience without staying in the academia.

Job security

I don't know how to support myself in DIY biology

I can do both. I have a home lab for early stage ideation and testing, then can move (if I like) to the academic lab for further development (if I choose) or at another private lab space (like community lab or lab-space-for-hire in biotech).

I need money. And I love DIY Biology because it's a way of doing science communication. My job is teaching biodesign and genetics at an art school. My job is science communication.

I have too many opportunities in academia right now. With my tech background & network I can also switch to a somehow better paid IT-job, if academia does not work out.

I prefer volunteering in DIY bio and occasionally helping projects with my work as research assistant.

This isn't a very well-thought out question. I'm not in academia - I'm in industry. So how can I answer the question that I would rather stay in academia than work in DIY biology?

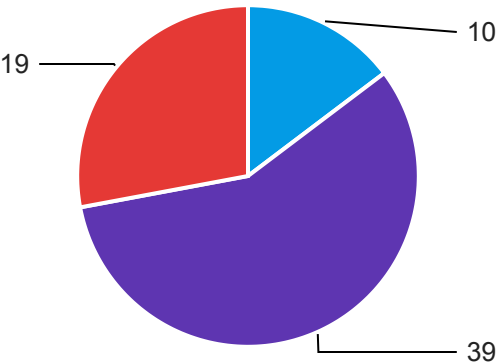
Job security and lack of infrastructure (issue related to the country).

n/a I left academia to work as a software engineer.

Q15 - Are you currently, or have you ever been, employed in the life sciences industry or a directly related field?

68 Responses

Used to No, never Yes, currently

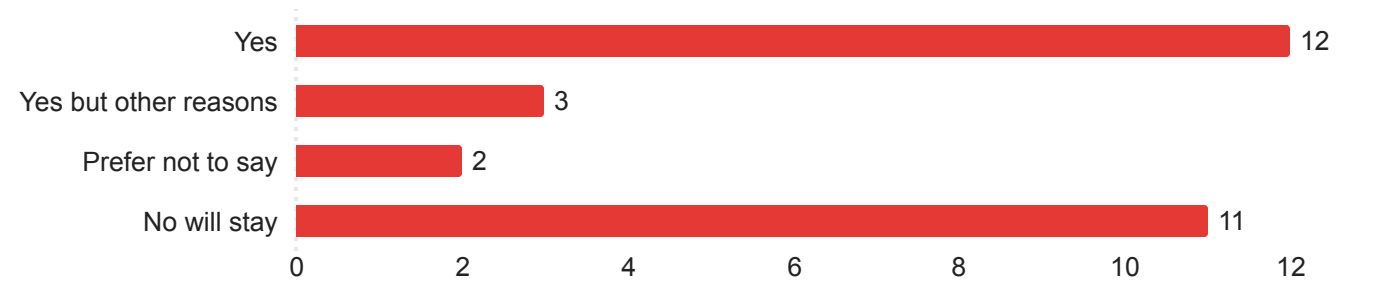


Field	Min	Max	Mean	Standard Deviation	Variance	Responses
Are you currently, or have you ever been, employed in the life sciences industry or a directly related field?	1	3	2	1	0	68

Field	Choice Count
Yes, currently	19
No, never	39
Used to	10
Total	68

Q16 - Did you ever, or are you currently, think about leaving your industry job to work in DIY biology full time?

28 Responses



Field	Min	Max	Mean	Standard Deviation	Variance	Responses
Did you ever, or are you currently, think about leaving your industry job to work in DIY biology full time?	1.00	4.00	2.43	1.37	1.89	28

Field	Choice Count
Yes	12
Yes but other reasons	3
Prefer not to say	2
No will stay	11
Total	28

Q17 - Why would you rather work in DIY biology than in industry?

10 Responses

Why would you rather work in DIY biology than in industry?

In drug development using biotechnology

To focus on social justice and systems change

I suppose because there is more freedom in doing your own projects vs working for someone else. Most of my employment post-university was due to the experience/traits I had developed pursuing DIYbio projects. I see great promise for DIYbio in transforming primary/high school education, establishing new commercialization pipelines, as well as new avenues for people to return to graduate-level studies.

I believe it has more opportunities for growth.

I am starting a company that sells biotechnology related reagents in small quantities, and also developing open source low cost equipment (qPCR machine). It's called MagnusLab.

Mentorship, teaching, and community building is far more rewarding than working in a company. It's a chance to grow a new field and to support wonderful people that want to learn.

Cause of the importance of Free Libre and Open Source biology, wetware, hardware, software

More room for creativity. Less of a rat race for funding. More opportunity for teaching than in my current job. More community effort than cut-throat competition

Teaching people how to make flowers.

It is more rewarding and offers both greater flexibility and greater rewards working directly with the community

Q18 - Why would you rather stay in industry than work in DIY biology full time?

9 Responses

Why would you rather stay in industry than work in DIY biology full time?

Income!

At this phase in my career, it is more practical to stay in the industry. I have to pay off student loans and then plan to pursue Ph.D. After this, I intend to start my own company, and I would then like to support DIY biologists to develop the future of my workforce. As a vehicle for my company to help the community we are situated within, DIY biologists will be an important ally and guide.

Question is poorly written because it appears to assume that DIY bio doesn't have a role in entrepreneurship / small business services / industry. What do you even mean by industry? Do you assume that DIY bio is only a hobby? I started a small environmental consulting firm and DIY bio is at the heart of our R&D and lab services

Stability

would like to work on startup in the fields while i stabilize an income stream

Because is a good job, i like to fat

money

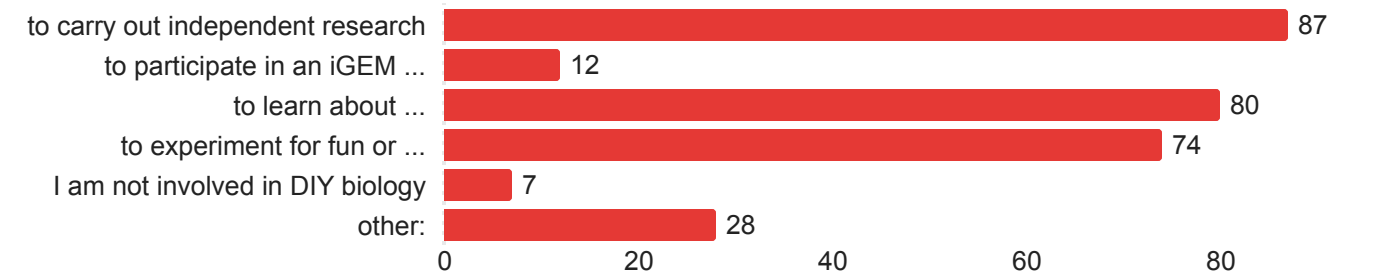
Not ready to take the risk, I want a steady income

There is no way to provide for myself merely working in DIY biology

I like food and a roof over my head.. also industry is a good way to fund my projects and provides easy access to a variety of environments to sample from

Q19 - Why did you first become involved in DIY Biology? (select all that apply)

136 Responses



136 Responses

Field	Choice Count
to carry out independent research	87
to participate in an iGEM competition	12
to learn about biology/biotechnology	80
to experiment for fun or entertainment	74
I am not involved in DIY biology	7
other:	28
Total	288

Other (please specify): - Text

To learn ways of bringing science into my community

Join a specific community project

also to run a business

Curiosity about its educational potential

To better understand and hopefully help fight climate crisis.

DIY biology feels more open to multidisciplinary fields. I never would've thought to combine design with biology.

outreach

To teach/enable others to learn biology/biotechnology

Just to see what was happening in the DiyBiology scene. Help others new to molecular biology.

participate in a biotech startup

Entrepreneurship

For self-improving - athletic performance, to combat aging

To use my skills at the bench/academic training to teach and bring experiences to those who are unable to enter traditional academic spaces

Educate the general public

Looking for interesting IP (intellectual property) conflicts and investigating innovation financing (eg social policy bonds)

To help the world.

Work on a project with social impact

To start a company

Worked for the ODIN which is an affiliate company

To help dogs and curiosity

to contribute into a biohackerspace

To teach

To informally continue my second undergraduate degree in molecular biology after having to leave the program/university/country. (First Bachelor's degree was in design.)

to explore creative ways to make biomaking accessible to youth and communities not engaged in the conversation of biodesign and biotech.

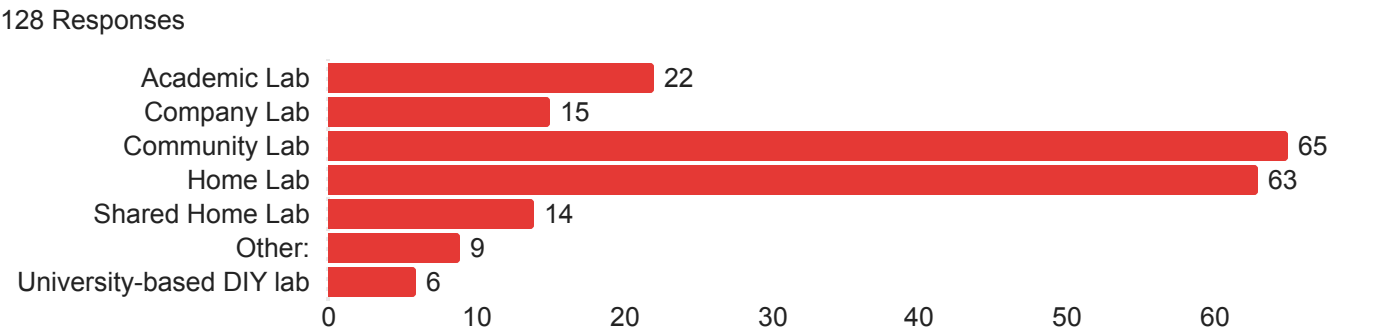
I was at a conference and it was presented as a way to do outreach.

The current pandemic made me jump into this :)

youth education of biology not related to iGEM. Again, not the best range of prompts...

The explore commercial product ideas.

Q20 - Where do you carry out your DIY biology work? (select all that apply)



128 Responses

Field	Choice Count
Academic Lab	22
Company Lab	15
Community Lab	65
Home Lab	63
Shared Home Lab	14
Other:	9
University-based DIY lab	6
Total	194

Other (please specify): - Text

not yet

N/A

I don't do it myself. I help others that do o include diverse communities though community engagement

My art studio

no currently active

home (theory, don't need lab)

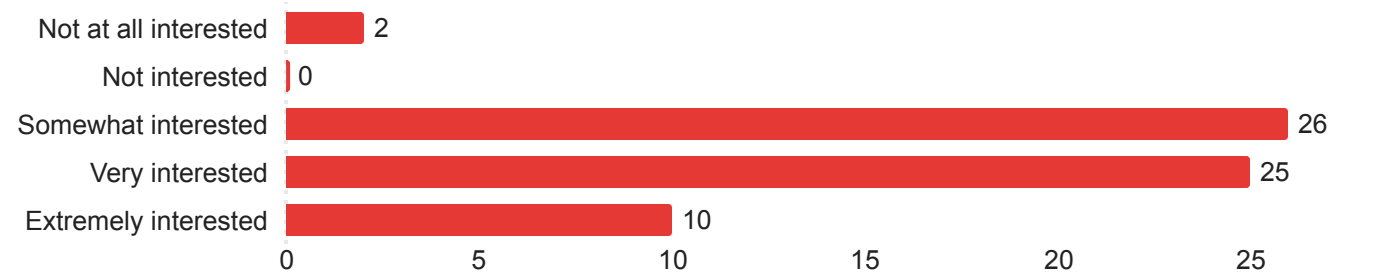
I haven't yet, just observing other people

Remotely, via wetware design and collaboration with others in DIYbio community and academia

Ethics researcher: home office

Q21 - How interested are you in working in a community lab?

63 Responses



Field	Min	Max	Mean	Standard Deviation	Variance	Responses
How interested are you in working in a community lab?	1.00	5.00	3.65	0.86	0.74	63

Q22 - In a typical week, how many hours do you spend on...

Field	Min	Max	Mean	Standard Deviation	Variance	Responses	Sum
...working with other DIY biologists?	0.00	60.00	5.64	9.95	99.06	125	705.00
...getting DIY biology supplies or equipment?	0.00	60.00	3.34	7.99	63.86	125	418.00
...literature research for your projects?	0.00	60.00	10.59	11.45	131.06	125	1324.00
...hands-on DIY biology lab work?	0.00	60.00	8.26	11.80	139.35	125	1033.00

Q23 - In the last two years I have (select all that apply):

120 Responses

Field	Choice Count
Been to a DIY biology event (e.g. conference or meet-up) namely:	65
Build my own Lab Equipement, for example:	56
Purchased Lab Equipment	62
Repurposed Common Household Items or Substances	66
Got access to lab equipment to a person or community	59
Purchased Reagents to Conduct Projects	60
Created my own Reagents, namely:	16
Acquired Reagents from another Person or Community	41
Used a Kit Designed for Biotechnology Education (tell us here if you know the name/manufacturer):	39
Used Online Bioinformatics Tools and Databases	75
Used a BioBrick Standard Biological Part	15
Acquired my Own Samples	54
Received Samples to Analyze from Others	36
Prepared Samples for Gene Sequencing	49
Extracted DNA from a Sample	67
Compled Gene Sequencing Samples in my own Lab	23
Done the Polymerase Chain Reaction (PCR)	64
Made recombinant DNA molecules	46
Inserted recombinant DNA into another Organism	49
Used a Genomic Sequencing Kit to Sequence my Genome	19
Ran some Form of Gel Electrophoresis	64
Grown Microbes Independently	63

Used Microbes to Tinker or Experiment with	57
Done Traditional Plant or Animal Breeding Activities	30
Done DIY Food Processing	37
Made Bio-Artwork	50
Other (please specify)	16
Total	1278

51 Responses

Been to a DIY biology Event (e.g. Conference or Meet-up) namely: - Text

Genspace, Biosummit

Global Community BioSummit

Global Community Bio Summit

Biosummit

TriDIYBio Meetups

Durham Community Lab Events

Classes at BOSLab

Global Community Bio Summit; regional meet-ups; local meet-ups

Biosummit, Biofabricate

Petalsmiths Plant engineering Party FB Tuesday meetups

BioSummit 4.0

Organized by Biocurious, Santa Clara, CA

Community bio summit

Biosummit, BioHTP

Meetup event

biosummit. various events at local biohackerspace

Makespace

Genspace's virtual classes, events, social hours

Genspace; I taught an online course

Global Biosummit
Gardens as Bioteck, Tokyo
Biofellows Training

Biosummit

hackerspace CRISPR experiment

Philly Maker Faire

SYNBIO Boot Camp 1.0
iGEM

Biohttp, prophase biostudios, bdyhax

Biosummit.
open Insulin

Biosummit

Global Community Biosummit

Community Biosummit

Tour of maker labs in Vancouver, maker labs in Victoria

Biohack the planet, Biohacking Village @ DEFCON, Biosummit, Catalyst Biosecurity Meetup

ABSA meeting, BioSummit, a few online gatherings

Biohack the Planet
Biosummit
GenSpace Workshop

Remotely, went to the DIYbio summit in 2020, and contributed to the OpenCovid19 initiative

Biohacking Village, Bio Summit

Biohack the planet

Pas Sage En Seine (fr)
IndieCamp (fr)
OpenPlant Meet-up
Frugal Science (Prakash Lab)
CCC (Conference)

BioSummit, plus several weekly meetups a week

Global Community Bio Summit

Global Community Biosummit

Open Science Network in Vancouver Canada

BioHTP

Biosummit

biosummit.org

meetup - biomakespace & OSN

Public Health Agency of Canada - Canadian DIYbio Summit

Bio summit, Learn.design.compute With Bio

Global Community Biosummit

Biosummit, BioHTP, DEFCON biohacking village

Biohack the planet, Defcon biohacker village, igem, global community bio summit

BioSummit, BioCurious community events, open Insulin events

BioSummit, JOGL events

COVID has really hindered the conference scene. But I've been to BioSummit, NewHarvest, Future of Food...

<https://biohackspace.org/2019/09/microscope-workshop/>

DIY Bio Summit

2 meetups on specific projects I am working on

52 Responses

Build my own Lab Equipment, for example: - Text

Microscope, light filter, incubator, environmental sensors

Home made media

septic box

DNA Purification line, Plant propagation space, Climat Box

This is my main area of interest. I like to show others how to build inexpensive equipment, as well as building equipment to automate lab processes.

I am working on simulation software

Bioreactors, pigment extraction

cell-phone microscopy stand

viscometer

Incubator, OD600, Transilluminator, Ender 3 BioPrinter, raspberry pi microscope, Raspberry Pi based Automated tardigrade culturing device, Photobioreactor, 3d printed lab accessories (Tube holders, centrifuge inserts, pipette sorting devices, etc)

Centrifuge

Gel Power Supply

UV light sanitizing system

Vacuum pump system

Centrifuge, electrophoresis chambers, electrophoresis powersupplies, gel illuminators, temperature controlled blocks, colorimeters

,

I made a formulations lab, and retrofitted a facility. I also made my own chemical reactor.

oven, pcr thermocycler, pH meter, conductivity meter

Plate hotel

Iontophoresis equipment for delivering EDTA into jawbone(to accelerate teeth moving whilst bone remodeling)

Laminar flow hood

Incubator

3D printed microscope parts

UV/vis spectrometer

microscope with camera dockings, spectrophotometer, uv transilluminator

Incubators, spectrometer,

Genspace's Open Plant Incubator project

Nano drop, centrifuge, incubator

electrophoresis box

DremelFuge - A One-Piece

Centrifuge for Rotary Tools

novel bioprinting platform

Plant incubator

Plant incubator

Incubator

Vortex

Microcentrifuge

Syringe pump, Optical density meter, Centrifuge, Incubator

Tube roller, centrifuge, OD600 meter, glove box, desk, supplies like inoculation loops, etc. A qPCR machine is in progress.

A fully automatic and automated pneumatic gene gun, bioinformatic pipelines, bioprinters.

gene gun using CO2 cartridge

Dremelfuge

DIY incubator, DIY microscope, DIY flow hood, my own software, etc

Vacuum manifold, bioreactor, mammalian cell incubator etc

DIY microfluidics from a Nail Studio hacking

DIY pregnancy test

Face mask testing rig

DIY shop vac vacuum formers to create DIY custom shaped petri dishes.

Binomica Labs GutHub

MiniSpec Modular Spectrometer

Cabbage Babbage Plant Grow Cube

See lab notebook for info, link in bio of any of my social media profiles

SDS-PAGE Gel cassettes

optical feedback ultrasonic levitation devices.

I tried to make an incubator and I fixed up a thermocycler that was going to be thrown out.

Building a few automated plate hotels

Diy bio printer

Gel electrophoresis chamber

Incubator, lab space/desks, etc.

Pipetting Robot, Bioreactor, Polarimeter, Hotplate, Scale, Shaker, Microscope, Pipetter, Laser Microscope, auto-sampler...

Temperature probes.

<https://biohackspace.org/2019/08/building-a-diy-flow-hood-mark-2/>

16 Responses

Created my own Reagents, namely: - Text

Media for organism growth

Loading dye, Polymerase, buffers, DNA Transformation buffers using laxatives, BioInks/support media

Taq polymerase, sso7d-Pfu

I have a novel material that I make

Miniprep reagents, competent cells

Dinitro-ortho-cresol

Iodoform

Ethanol

Ether

Plasmids

Agarose

Plasmid extraction kits, competent cells kit, some colorimetric assays, starting to produce some enzymes now.

Working on making my own cellular reagents dna polymerase

New mixture for eukaryotic cell culture

Mostly Media and buffers

Almost every buffer I use I have made a homebrew variant of

plasmids made using recombinant DNA technology, e.g Open Enzyme Collection parts in vectors for protein expression.

Bioprinting gel has ur of flax seeds

Enzymes :)

32 Responses

Used a Kit Designed for Biotechnology Education (tell us here if you know the name/manufacturer): - Text

Monarch

ecovative

The Odin

Magical Microbes MudWatt

Carolina Biological Supply

MiniPCR, Bio-Rad, Amino Bio, stuff from Carolina/Ward's, etc.

MiniPCR bio

NEB

amino labs

Biorad GFP transformation kit

pGREEN transformation / Carolina.com

Odin

Amino labs

Monarch

The Odin

Amino

the odin

The-Odin

(at the hackerspace)

www.The-ODIN.com

Scintia

FreeGenes kits for Covid-19 diagnostics.

BioBasic

Amino One bacteria transformation station

The Odin, Carolina Scientific

DIY mushroom kits for teaching young (grade school) kids, premade to avoid spreading spores

The-Odin

Pocket PCR (Gaudi Labs)

Electropen (IGEM)

Amino Labs, Odin, Carolina

Edvotek

Carolina

Zymo

Bioneer

NEB

Thermo

Teaching synthetic biology to community lab members with, for example, Lethbridge, Alberta's amino.bio kits.

Amino lab, CRISPEE, dna detective

Carolina

Bioengineering101/TheOdin

16 Responses

Other (please specify): - Text

Created a new IRB (human subjects review committee)

Implants

uLoop assembly in replace of biobricks.

not active

Researched - microbiome and it's effect on health

Growed mycelium of Amanita species

Made tissues preparations according to professor Fylatov(biogenic stimulators)

design ppe, transpulmonar sensor, build ventilator for covid19 patients

Organized other DIY biologists and worked on non-profit organizational projects

designed 3D-printable puzzle piece-like representations of nucleotides

Not biobricks, but designed and received standardized DNA part collections from the Free Genes project

Cell culture transfection, sds page, giga-prep, made mini-minicircles, human transient transfection, ELISA for hormones, antibodies and viral proteins produced in vitro and in vivo, surrogate virus neutralization assay, primary tissue culture, sperm mediated gene transfer.

to carry out 20 workshops in popular education with non scientific public

raised mealworms to collaboratively make art from polystyrene they ate.
Created frugal science tools such as DIY millifluidic tools with laser cut coffee filters and tape.

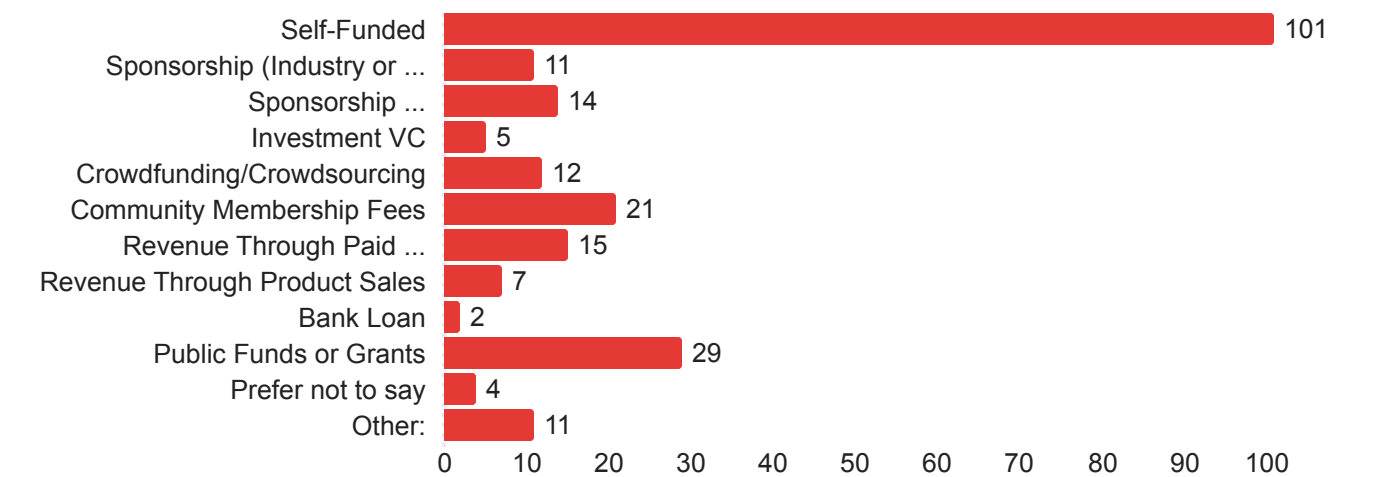
Protein Purification of enzymes, Designed Open Yeast Collection of DNA parts for metabolic engineering - currently undergoing synthesis through BioBrick Foundations FreeGenes program.

Just to be a pain, I think you should distinguish bioart and biodesign. This survey is great, and I guess it's not needed, but I know my art students can be absolute pains in the butt when it comes to differentiating art and design.

DIYBio during COVID was a bust!

Q24 - How do you pay for your DIY biology activities? (select all that apply)

118 Responses



Field	Choice Count
Self-Funded	101
Sponsorship (Industry or Corporate)	11
Sponsorship (Philanthropist/Individuals/Angel Investors)	14
Investment VC	5
Crowdfunding/Crowdsourcing	12
Community Membership Fees	21
Revenue Through Paid Workshops or Training	15
Revenue Through Product Sales	7
Bank Loan	2
Public Funds or Grants	29
Total	232

Other (please specify): - Text

Going broke!

Need funding

Business services

My grad program pays for it

unemployment insurance

no cost (theory)

Volunteering

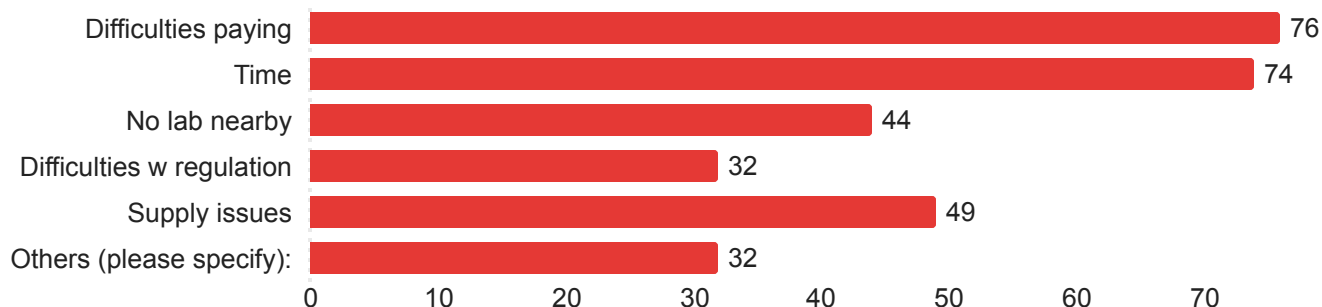
Patreon

NGO investigation programm

Creative exuberance!

Q25 - What are some of the challenges you've faced doing independent DIY biology work and activities? (select all that apply)

117 Responses



117 Responses

Field	Choice Count
Difficulties paying	76
Time	74
No lab nearby	44
Difficulties w regulation	32
Supply issues	49
Others (please specify):	32
Total	307

Others (please specify): - Text

As a small business owner, some of the large suppliers like VWR, Thermo Fischer and IDT can be very difficult for us to work with. They come up with their own rules for which businesses qualify to access supplies and equipment. (Does your business have a website? Does your mailing address match your shipping address? Do you have an institutional telephone number or email address? Who is your PI?) For example, VWR arbitrarily designated my lab as a residential address, despite it being located at a commercial biotech accelerator, and so they won't let us order supplies. Their decision making process is completely opaque and not based on any laws or regulations. Yet they are one of the major gatekeepers for accessing lab supplies. It is absolutely infuriating.

Getting people with wetlab experience to collaborate on projects

Getting access to journal articles

The realization that typical scientific practice needs to be reformed, so I should not contribute to it (typical practice is for research to become more expensive and therefore less likely to be independently tested because less expensive research is less likely to be published/trusted)

Access to scientific knowledge or practices

I tried setting up a DIY bio lab in my region, but it was extremely difficult at the time while also working a full-time job. I have hopes of trying it again later though!

Not being connected to a university

Main concern is running the lab and keeping revenue coming in. Things were going well before covid with workshops, grants, etc. Trying to get momentum back up and going is hard when we are in and out of stage 4 lockdown.

not active

Want more equipment in the community lab, and want more space

not having a technical background in science.

Supplies very expensive

getting crazy people with absurd ideas (o3-uv disinfectant machine for home use against covid19)

Access to amicable mentors.

People calling it Do It Yourself biology. It's really not. It's a community effort with no-one working in isolation.

not getting quality man power

Cost of membership and lab equipment and reagents. Let's not beat around the bush, this is the biggest barrier to entry, to starting a community lab, to joining a community lab, to finding a community lab, and to keep going to that community lab when it's so far away and hard to get to before. Now that there's a pandemic outside and it's not even open, well... that's just impossible now. If you're looking to spin this question as a way to address how to improve access, it's kind of systemic: it's hard to start an independent DIY biology lab, hard to get people to attend it, pay for it, and keep it funded and afloat, and hard to keep going. How do you break down science barriers in general so more people can even consider the idea of going to do science as easily as they think of going to play basketball? How do you make it FREE -- because a STEM education is EXPENSIVE, and so is a membership to a DIY lab. I wasn't kidding about being broke and using my Unemployment Insurance to pay for my membership. This isn't even the first time I'm sad to admit. I have the most time to actually go to this lab when I'm unemployed. Getting employed in this field was hard before the Pandemic hit. And when Lab Technician wages pay only slightly more than McDonald's, it really makes people question why they are even in this field to begin with.

A community that I can ask questions of. I realize this survey was posted on the DIYbio google group, but I don't often engage with that community.

Getting funding (starting an NGO to see if as a group is easier to get funding)

COVID-19 pandemic shut down our community lab.

Licensure, we got approval for DIY as a path to a startup but found that they had looked at our DIY prototyping as inconsequential and reneged on a non-binding written and verbal licensure agreement when it became clear we were able to replicate the technology (we did not realize it was non-binding per our university's policy as it was not explicitly stated and the IP owner did not realize we had recruited a former member of his lab)

Access to financing, import times of products or equipment and customs retention times, permit times from regulatory entities and evaluation times for procedures of research bioethics commissions. DIYBIO is not on prioritized lists for investment or financing at the state level so it is difficult to access funds without having a legal structure. The high costs of importing products or cost overruns for distributors of multinational companies.

Need to learn more

Trying to use cheap materials to produce equipment. Now we realize some key components should be of utmost quality, while others can be cheaper. But this fits in the first item "Difficulties paying for DIY biology equipment, supplies, membership etc.".

I couldn't make enough money doing independent research and had to start a company

Limited access to the most up to date scientific papers

Overall, I am happy with where my community lab is at but the high cost of real estate - commercial and residential - impacts community participation.

Not enough basic training outside academia (or, not enough knowledge of where to look)

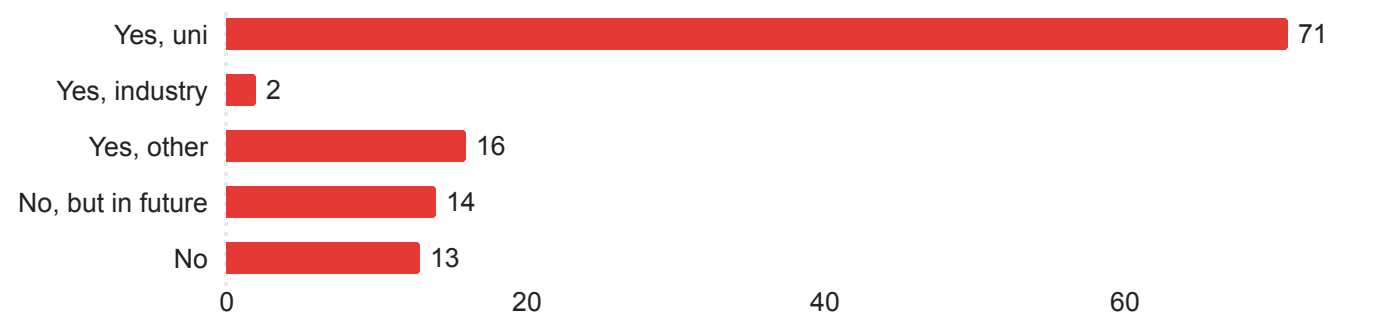
short attention span.

The whole pandemic thing.

N/A

Normal research challenges

Q26 - Have you done any wet lab training?



Field	Choice Count
Yes, uni	71
Yes, industry	2
Yes, other	16
No, but in future	14
No	13
Total	116

Yes, through another institution or program (please specify): - Text

- through community labs only
- TriDIYBio offers workshops
- BUGSS
- Industry and in university
- Community biolab
- Genspace, BioBuilder at Lab Central, Synbiota science hack
- GCBS
- TheL4b in LA

at the hackerspace (not much, just using the kit)

Community lab class and one-on-one training in the lab.

Community biolab only

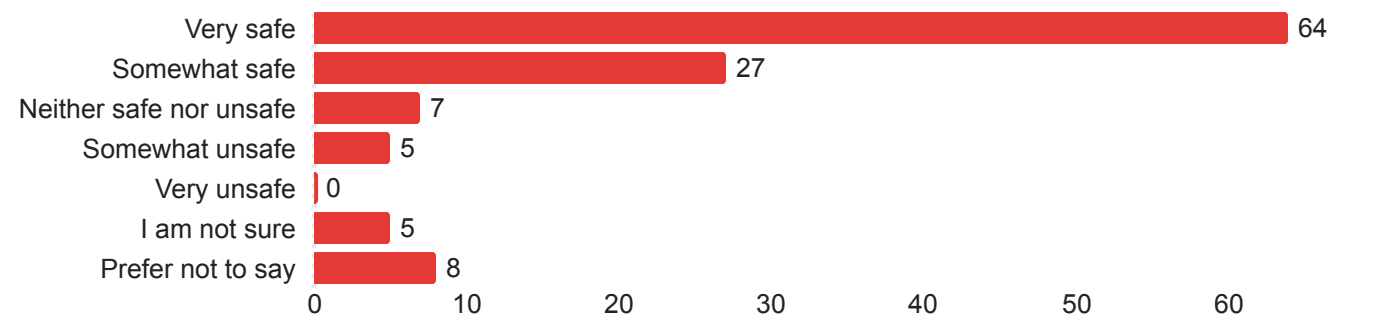
whitin different biohackerspaces

No formal training - I've picked up all my wet lab skills through peer-to-peer training at community labs

Bio builder

Through my community lab

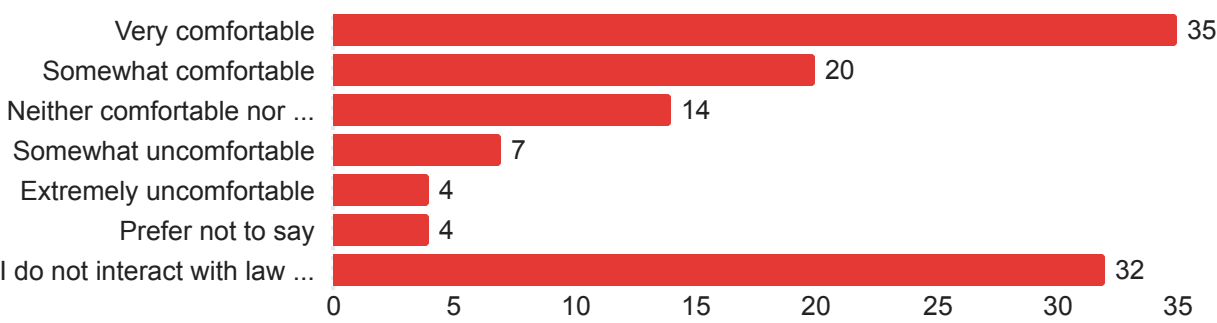
Q28 - How safe do you feel your DIY biology space is?



Field	Min	Max	Mean	Standard Deviation	Variance	Responses
How safe do you feel your DIY biology space is?	1	7	2	2	3	116

Field	Choice Count
Very safe	64
Somewhat safe	27
Neither safe nor unsafe	7
Somewhat unsafe	5
Very unsafe	0
I am not sure	5
Prefer not to say	8
Total	116

Q29 - How comfortable do you feel when you are in contact with biosecurity and/or law oversight agencies concerning your DIY biology activities?



Field	Choice Count
Very comfortable	35
Somewhat comfortable	20
Neither comfortable nor uncomfortable	14
Somewhat uncomfortable	7
Extremely uncomfortable	4
Prefer not to say	4
I do not interact with law enforcement or other oversight agencies	32
Total	116

Q30 - Can you name some resources that guide your safety practices?

83 Responses

Can you name some resources that guide your safety practices?

Biosafety (level 1 to level 4) handbook & guidelines provided by country government

I've been traditionally trained in a university setting and industrial setting from undergraduates, graduate students, PhD's, and industry professionals.

Personal and professional experience; repurposing protocols learned at university

DIY biosafety manual
BMBL

I do not work with pathogenic agents. Just yeast

My practice do not involve biological hazards

All official rules and regulations that apply in this country. I am familiar with them due to my main work. Usually my projects do not interfere and far from

We adhere to BSL-1 practices. Most of our work has been with soil samples

Latest iGEM safety guidance (even though not part of iGEM this year) and talking to other biologists both DIY and professional combined with 4+ decades of life experience.

<https://osf.io/9e3gx/wiki/home/>

<http://ses.gov.ua>

Blogs

NIH guides and Lab Safety Manual

biosafety hand book made

<https://www.genspace.org/community-biology-biosafety-handbook>
<https://www.cdc.gov/labs/BMBL.html>

OSHA

Mainly AS/NZS 2243.3:2010 and The gene technology act 2000 Act/Regs (AUS)
All of which is boiled down in our Community lab manual into practical steps as well as lab induction/safety training for all new members.

Guide on working with GMOs from University

We have a handbook to follow in our lab

Yo busco distintos protocolos, asegurandome de que no tengan peligro. De ahí, los sigo perfectamente

<https://www.chemwatch.net/download/>
https://www.researchgate.net/publication/303699006_Do_It_Yourself_Biology-Committed_Hobbyists_or_Dangers_to_the_Public_Safety
<http://biochem.du.ac.in/web/uploads/30%20Guidelines%20for%20Safety%20in%20Biotechnology.pdf>

<https://diybio.org/codes/draft-diybio-code-of-ethics-from-european-congress/>
https://www.cdc.gov/labs/BMBL.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fbiosafety%2Fpublications%2Fbmb15%2Findex.htm
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3706168/>

These are from industry and academia, essentially OSHA guidelines.

Thorough research on all equipment and materials used. If unsure about anything I will seek out feedback from those who are more experienced and knowledgeable.

CDC biosafety handbook

Lab safety manual

Community lab safety manual and in person training

Common sense.

university and tech lab courses (cfgs, spain)

Textbooks, Online resources / guides / youtube

NIH biosafety manual

Our community lab's biosafety committee which has an email address where you can ask questions (and must get permission for all new projects). Our lab's biosafety training documents. Reading local laws, regulations and recommendations.

OIE guides

WHO manual for safety, HUJI biosafety manual

CDC, USDA, NIH, DIY Biosafety Manual (it's on GitHub now)

Pc1 requirements from the Australian government

At Genspace, we learned about the BSL ratings. I only use K12 bacteria, which is BSL-1, mostly for art purposes.

NIH Guide for Care and Use of Laboratory Animals, etc

Biotechnology dept safety standards

BSL Guidelines

MSDS, Laboratory Manual, Institutional Biosafety training

CDC WHO

Protocols used in my graduate studies lab

Information found on government websites

Community biology safety manual

Community lab protocols

School documents

I have significant (>10 years) training in academic microbiology labs so I have extensive literature on lab safety protocols, including standard protocols produced by organizations like the EPA.

general scientific knowledge & common sense

Bio-safety level 1 guidelines and training provided by my community lab staff.

MS Tissue Engineering

Biosafety Standard Operating Procedures (POA)

Protocols and Methodologies submitted to the National Research Bioethics Commission when tests are carried out on animals or humans.

Some cases: risk assessment.

Scientific Advisory Committee for Biosafety

Online

No

NO

None, have not done any experiments, have only read about things and played around with bioinformatics tools

University

School practice, regulations, learning from mentors

My country's regulatory agencies site, books like "Laboratory Biorisk Management: Biosafety and Biosecurity", youtube videos...

My own personal training, both professionally and community guidelines