Development of a sustainable synthetic biology workshop at a community laboratory

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Community Labs and DIY Biologists

GETTING STARTED
A garage biolab can be set up for a few hundred to a few thousand dollars. The cheapest source of used lab equipment is often eBay, but beware sellers who say they aren’t able to verify whether or not the equipment actually works. In such cases, it usually doesn’t. LabX.com and BestUse.com are more reliable but also tend to be pricier. And would-be biohackers can also scout out downsizing biotechnology and pharmaceutical companies for deals.

IMPROVISATION IS KEY
To do molecular biology on the cheap, biohackers have developed some creative workarounds:
• for a $10 microscope, pop the lens off a webcam and stick it back on backwards.
• for an $80 centrifuge, order the DremelFuge rotor and attach to a Dremel rotary tool.
• for a free 37 °C incubator, incubate tubes of E. coli in your armpit.

THE BIGGER TICKET
Some standard laboratory equipment such as fume hoods can get quite expensive, but one should not sacrifice safety for cost. For guidance on the necessary equipment, consult with local biohacker groups. Another option is to join the institutional biosafety committee at your local university or medical centre. These committees often have slots for nonscientists.

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DIY Biology Groups/Community Labs

NORTH AMERICA

Atlanta, GA
Baltimore, MD
Berkeley, CA
Boston, MA
Brooklyn, NY
Cambridge, MA
Carlsbad, CA
Chicago, IL
Denver, CO
Guanajuato, MX
Houston, TX
Jackson, MS
Los Alamos, NM
Los Angeles, CA
Nashville, TN
New York City, NY
Norfolk, VA
Oakland, CA
Portland, OR
San Diego, CA
San Francisco, CA
Seattle, WA
Sunnyvale, CA
Toronto, ON
Vancouver, BC
Victoria, BC

http://www.meetup.com/DIYBio-Atlanta/
http://www.facebook.com/groups/DIYBioAtlanta/
http://www.berkelleybiolabs.com
http://bosslab.org/
http://genspace.org/
http://openwetware.org/wiki/MIT_DIYbio
http://biotechnobeyond.com/
http://groups.google.com/forum/#forum/diybio-chicago
http://denverbiolabs.com
https://www.facebook.com/groups/DIYBioMexico/
http://www.brightworkscaresearch.com/
http://www.diymeareotech.com/
http://biodidact.net/
http://www.biologiklabs.org/
http://www.facebook.com/CounterCultureLabs/
http://www.meetup.com/DIYBio-Miami/
http://www.meetup.com/DIYBio-San-Diego/
http://www.meetup.com/DIYBio-Nashville/
http://www.meetup.com/DIYBio-NYC/
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http://www.meetup.com/DIYBio-SanFrancisco/
http://www.meetup.com/DIYBio-Seattle/
http://www.meetup.com/DIYBio-Sunnyvale/
http://www.meetup.com/DIYBio-Toronto/
http://www.meetup.com/DIYBio-Vancouver/
http://www.biospace.ca/

EUROPE

Barcelona, ES
Berlin, DE
Budapest, HU
Copenhagen, DK
Cork, IE
Eindhoven, NL
Graz, AT
Groningen, NL
Kiev, UA
Lausanne, CH
London, UK
Manchester, UK
Munich, DE
Namur, BE
Nottingham, UK
The Hague, NL
Paris, FR
Prague, CZ
Reyners-VD, CH
Stockholm, SE
Switzerland, CH
Trento, IT

https://groups.google.com/forum/#!forum/diybio-barcelona
https://groups.google.com/forum/#!forum/diybioberlin
http://biolinklab.tyrrell.hu
http://biologigaranen.org/
https://groups.google.com/forum/#!forum/diybio-ireland
http://bioartlab.com/
https://www.facebook.com/OpenBioLabGraz
http://www.ldbionline.org/
https://groups.google.com/forum/#!forum/diybio-kiev/
http://www.eprouette.ch
https://groups.google.com/forum/#!forum/diybio-london
http://dylbio.medlab.org.uk/
http://biogarage.de/
http://www.dylbio.be/
http://opengenx.wordpress.com/
http://lapalissage.org/
http://brmlab.cz/project/biolab
http://www.hackasylum.ch
http://thimbiobiohackers.wordpress.com/
http://hackterl.org/
http://www.openwetlab.org/
Community Lab Activities

- Laboratory space
- Shared instrumentation
- Lab management
- Community projects
- Classes
- Public lectures
- Community outreach (schools, science fairs)
- Safety training/oversight (“neighborhood watch”)

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*In Attics and Closets, 'Biohackers' Discover Their Inner Frankenstein*

Using Mail-Order DNA and Iguana Heaters, Hobbyists Brew New Life Forms; Is It Risky?

By JEANNE WHALEN

Updated May 12, 2009 11:59 p.m. ET

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*Genetic Science Oozes Out of Amateurs' Garages*

by Jeremy Hsu | September 27, 2010 05:27am ET
DIY Biology Scientific Areas

- **Projects**
  - Synthetic biology projects
  - iGEM (community lab track)

- **Interdisciplinary projects**
  - Art
  - Food, Brewing, etc.

- **Technology development**
  - Open PCR
Goals of our outreach project at BUGSS

- Increase knowledge in synthetic biology among local community members
- Public lecture in synthetic biology (streamed online)
- Increase the number of individuals exposed to techniques in synthetic biology
  - 5-week Build-a-Gene course
- Transition workshop participants into long-term community lab members
- Member projects
The Build-a-Gene course

**Synthetic Yeast Project**
- Synthesize entire yeast genome
- Assemble oligos into building blocks and building blocks into chromosomes

**Build-a-Genome**
- Synthesize portions of yeast chromosomes
- Assemble oligos into building blocks (undergraduates)

**Build-a-Gene**
- Synthesize individual genes
- Assemble oligos into one building block (Community Lab)

Use bioinformatics tools to break gene into oligonucleotides

Assemble oligos by polymerase cycling assembly to create building blocks (promoter and coding sequence)

Restriction digest, ligation, transformation OR Gibson Assembly

Colony screening PCR and DNA Sequencing
Who have we reached?

- 40 participants for lecture, 20 for course, 2 continuing on weekly member projects, 1 becoming member of Board of Directors

- Range dramatically in occupation
  - Faculty at arts college
  - Lawyer retraining in the biological sciences to enter patent law
  - Entomologist
  - High school teachers and students
  - Computer engineer

- From as far away as northern Virginia and University Park PA
2015: Building on previous success

- Expanding course offerings to a 4-course sequence in molecular and synthetic biology (including Build-a-Gene)

- Defined two member projects that receive consistent support from leadership
  - Biological lead sensor
  - 3-D biological printing

- Increase course enrollment
  - Use undergraduate students who have previously taken course as TAs so that we can accommodate more students in each course

http://www.jimmiresearch.com/about
How can you become involved with community labs?

- **Education**
  - Weekend/evening/summer courses, continuing education, after-school programs

- **Public lectures**
  - Direct communication with the public about new developments in biology

- **Incubators for commercialization and biotech startups**

- **Opening new avenues of funding (Kickstarter, Experiment.com)**
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