Bento Lab Stories

Towards Open and Accessible Biotechnology

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Summary and Mission Statement

Bento Lab is an all-in-one DNA laboratory that combines the essential tools for DNA analysis. It includes a laboratory centrifuge designed to extract DNA at high forces, a thermo-cycler for polymerase chain reaction, and a gel electrophoresis chamber and transilluminator for imaging. It was designed to be cost-effective, accessible and easy to use, which is particularly empowering for beginners, who can practice the practical skills of biosciences work at their own speed, and for research uses in remote settings.

We believe that when technologies become democratized, innovation accelerates. Bento Lab increases the capacity to have a hands-on relationship with genetics, and impacts everybody from schools educators, to agriculturists, to citizen scientists. Bento Lab aims to nurture curiosity in genetics, catalyze inclusive and accessible research, and thus help lay groundwork for using genetics as a tool in tackling world crises.

Our Mission - An Inclusive Future for Biology

Genetics and molecular biology are the fundamental technologies of life. They concern all of us. And yet, only a small number of experts have access to laboratories and specialist knowledge. This is a problem caused by equipment that is closed and expensive and hardware and software that is difficult to use.

Instead, let us look at how movements like Arduino or Raspberry Pi are empowering citizens to co-create and be technology-literate.

By building a diverse community around inclusive and accessible molecular biology, we want to enable professionals and non-professionals to engage with genetics in an open and responsible way. This is for everybody: curious makers, ambitious students, innovative artists and cutting-edge scientists.

Selected Case Studies

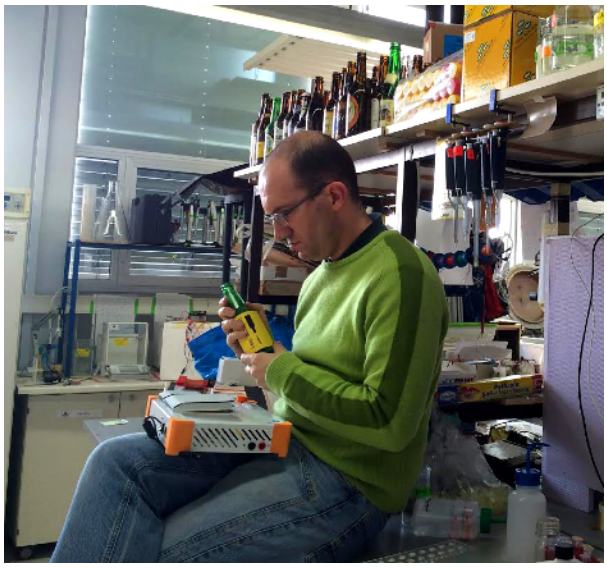
Researching and Teaching Biodiversity

Stephane Boyer is a Lecturer at Unitec Institute of Technology in Auckland New Zealand. He uses Bento Lab to teach Molecular Biology to students interested in a biodiversity. He also offers 1 or 2 days outreach workshops for school kids and the general public. Stephane's research focuses on biodiversity assessment and species identification. He often travels to remote places to collect DNA samples, and using Bento Lab he can check that the samples are of good quality before bringing them back to the lab.

"Bento Lab allows me to give each student real hands-on experience in molecular analysis. I want to put a Bento Lab in the hands of everyone of my students" – Stephane Boyer

Related Video Interview with Stephane Boyer

Decoding the DNA of Beer for precision brewing

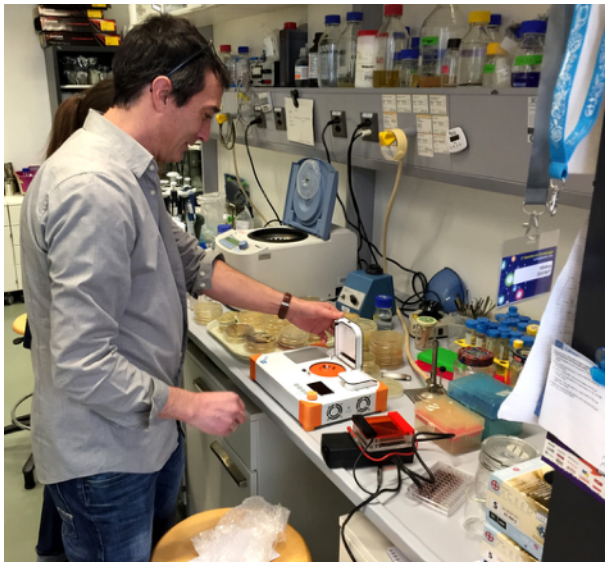


Founder of BeerDeCoded, Gianpaolo Rando is on a mission to understand craft beer at molecular level. Inside a Swiss biohackerspace he prepares DNA libraries for sequencing 1,000 beer microbiomes with the Bento Lab. Portable genomics can also help breweries to understand their processes, benchmark new recipes and explore new brewing spaces.

"With a Bento Lab it is much easier to survive the postdocalypse and keep doing genetic research."
– Gianpaolo Rando

Related Video Interview with Gianpolo Rando

Biology In Every Classroom



BiOutils is a science communication platform from the University of Geneva, Switzerland. Its mission is to support the teaching of modern experimental biology, providing material and know-how to teachers and classrooms. Active since 2007, its services are requested by 100% of the Geneva secondary schools and teachers enjoy with increasing demand its fundamental support (Caine et al., 2015b). With Bento Lab, BiOutils will bring to classrooms an innovative approach to perform experimental biology, allowing every student to manage their own mini-laboratory.

"Bento Lab helps me fulfil my dream… bringing a piece of a real research lab into a classroom environment!"
– Dr. Karl Perron, BiOutils head and Microbiologist

Related Video Report and Interviews with King Solomon Academy School, London

Recording Fungi for local citizen science

David Harries is a fungus enthusiast. As part of the Pembrokeshire Fungus Recording Network, he documents and collects fungus fruit bodies. Using Bento Lab, the team extracts fungal DNA from tiny specimen fragments, and isolates and verifies a "barcode" section of the DNA from each sample. Working with a local university, these samples are then sent away for sequencing. The information gained from the DNA sequences, combined with field observations and microscopical characters, contributes to a better understanding of the relationships between fungus collections in Pembrokeshire, UK.

"Bento Lab enables citizen scientists to explore fungal diversity and gain a better understanding of the science that underpins molecular studies." – David Harries

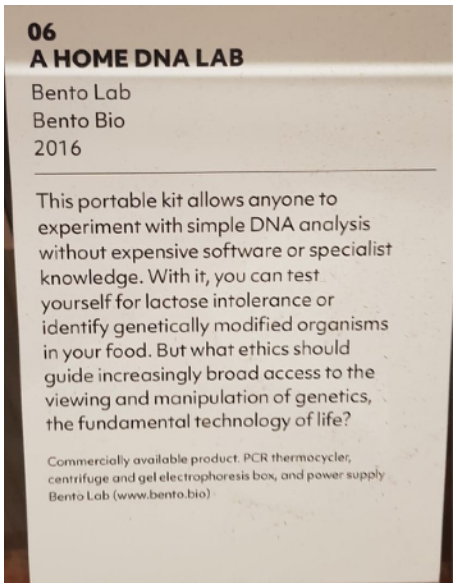
Related Video Interview with David Harris

Exhibitions

The Future Starts Here

Victoria and Albert Museum, London (May - November 2018)

"From smart appliances to satellites, artificial intelligence to internet culture, this exhibition brings together more than 100 objects as a landscape of possibilities for the near future."



Bento Lab model in **The Future Starts Here**

More information on the Exhibition Website

Beyond the Lab: the DIY Science Revolution

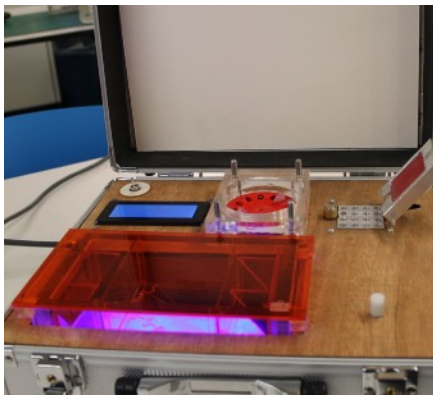
(exhibition shown in Dublin, London, Lisbon, Granada, Bonn, Luxembourg, Copenhagen, Warsaw, Budapest, amongst others)

Beyond the Lab tells the stories of a growing number of 'DIY scientists' around the world who are busily hacking, experimenting and inventing in the field of healthcare.

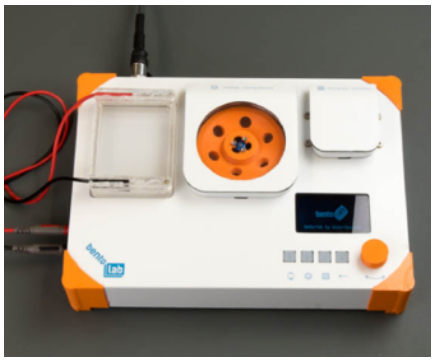
These citizen scientists often work with professional researchers to gather and analyse scientific evidence helping to understand local environment and face public health challenges such as air pollution, antibiotic resistance or disease outbreaks.

Bento Lab beta model shown in **Beyond the Lab**

Origin and Background



'Darwin Toolbox'
Initial Concept Build



Hand built beta model

Promotional model for
Kickstarter campaign

Bento Lab was created by Bethan Wolfenden and Philipp Boeing whilst studying at University College London, to make biology tools accessible and easy to use. After organising hands-on biotechnology workshops in schools and community centres, Bethan and Philipp were increasingly frustrated by the lack of accessible hardware. This led to the creation of Bento Lab. "We were both really excited by the potential of the maker movement and citizen science, but we saw a lack of easy-to-use equipment and kits for biology, when compared to Arduino for electronics or Raspberry Pi for computing", says Philipp Boeing.

In September 2015, using funding awarded as prizes from the London E-Challenge, UCL's Bright Idea Awards, the IBLF Awards and the Royal Academy of Engineering's ERA Foundation Entrepreneurs Award, twenty Bento Lab test units were built and sent to beta-testers all around the world.

Bethan Wolfenden says: "In 2013 we went to a maker festival in Rome with a laboratory in a suitcase that we had built in a weekend. We talked to thousands of people about the idea of an easy-to-use biotech laboratory, and this really inspired us to go forwards". Over the next two years, they constructed several prototypes with a team of students at UCL's Institute of Making, and tested them at workshops and science festivals. "We received incredible support from the community and a lot of interest from academics and teachers, but also from citizen scientists and people curious about genetics."

With the prototypes, the team have won awards from the Royal Academy of Engineering, UCL Advances and Imperial College's SynbiCITE. To go further, Bethan and Philipp partnered up with experienced RCA alumni Instrument PD and Kudu Studio and raised over £150,000 on crowdfunding platform Kickstarter to invest in a manufacturing set up and educational resources.

Our Founders

Bethan Wolfenden and Philipp Boeing
Beyond The Lab exhibition

Bethan Wolfenden studied Biochemistry (BSc) at University College London to follow in the footsteps of her childhood hero Jay Keasling, a pioneer in the field of Synthetic Biology. She began pursuing a PhD, researching how novel therapeutics can be delivered via the gut microbiome, before focusing on Bento Lab. As an undergraduate, Bethan led UCL's social enterprise society, and she founded a project teaching science journalism to school students. Bethan has also participated and advised UCL's teams for iGEM (the international genetically engineered machine competition). Since 2012 she is an active participant of the European DIYbio movement, exploring how molecular biology can be practiced in citizen science contexts. She supports WISE (Women in Science Education) and is passionate about increasing diversity in the maker movement.

Philipp Boeing studied Computer Science (MEng) at University College London with a focus on Synthetic Biology as part of the Computational Systems and Synthetic Biology group at UCL's Department of Cell and Developmental Biology. Philipp has been involved in iGEM (the international genetically engineered machine competition) since 2011, by leading and advising teams at UCL, hosting the UK "Young Synthetic Biologists" conference and serving as a judge in 2014. After leading a collaboration between the 2012 UCL iGEM team and a local group of "London Biohackers", Philipp grew increasingly passionate about access to biotechnology in citizen science. In 2015 Philipp spent time with the bio-media-arts group BCL.io in Tokyo, supported by a scholarship from the Heinz Nixdorf Foundation, exploring the intersection of art, society and biology.