EUROPE EU aims to ease migration for researchers and students **p.511**

PUBLISHING Flaws in papers are being caught more rapidly **p.511**

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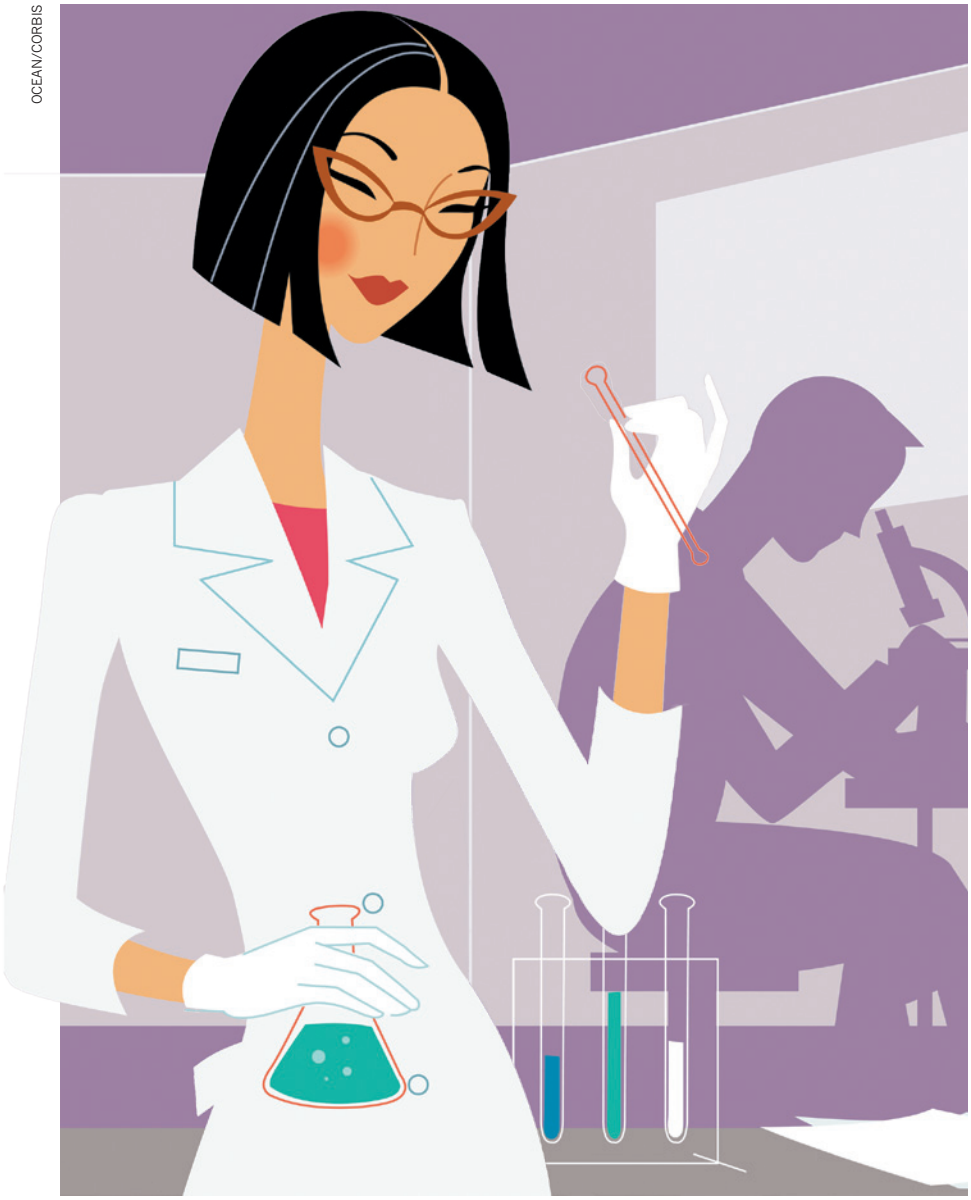

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BIOTECHNOLOGY

Independent streak

Scientists willing to take a risk are setting up individual research operations in rented lab space.

BY VIRGINIA GEWIN

Ethan Perlstein was frustrated. As a non-traditional postdoc, he had spent five years running an independent lab at Princeton University in New Jersey. He wanted to continue doing what he had trained for, but a tough academic job market meant that he had no guarantees. So he decided to move to a noted biotechnology hub, California's San Francisco Bay area, to try launching his own lab without the support of an academic institution.

His goal is to validate a drug-discovery protocol and start networking with potential investors. Perlstein explored several lab spaces, and in July he signed a two-month lease for a bench at the Molecular Sciences Institute, a non-profit research facility in Berkeley, California.

Perlstein is one of a growing number of young scientists who, stymied by the lack of jobs or the slow pace of research in academia, are pursuing cutting-edge research in their own spaces. Research tools and lab areas are becoming more affordable, particularly in the communal set-ups dubbed biohacker spaces, which seek to enable biological experimentation for hobbyists as well as for entrepreneurs. Funding schemes aimed at early-stage companies are also starting to offer a way to pursue an independent science career. Despite the risks, the option of launching an individual research operation is gaining traction throughout the United States and Europe.

Such routes, however, involve striking out into the unknown. Some non-profit, volunteer-driven hacker spaces are struggling to stay afloat, and it is not yet clear how independent research operations will become sustainable, especially if their work has no immediate practical applications. Young scientists eager for this brash brand of independence should consider their research needs, find out which spaces are optimally set up to help them, and determine how best to secure financial support.

HACKER CRAZE

The first biohacker spaces were fuelled by the do-it-yourself biology movement, in which untrained hobbyists started running biotechnology experiments in their kitchens and garages (see *Nature* **467,** 650–652; 2010).

These days, both amateurs and professionals are seeking out cheap lab space. The set-ups vary: hackers can rent a stretch of lab bench at GenSpace in New York, for example, for US$100 per month including access to reagents and ▶

some biotechnology instruction. But scientists working on specific projects often have more specialized needs, and a new model is emerging in the United States. The hybrid 'hackubator' fuses the independence and affordability of hacker spaces with the entrepreneurial bent of biotech business incubators.

Bio, Tech and Beyond, a hackubator space that opened this month in Carlsbad, California, charges $400 per month for a lab bench — much less than the roughly $900 per month of conventional biotech incubators. Members get access to centrifuges, cell-culture incubators, plate robotics and three-dimensional printing, as well as help with writing grant applications.

"Biotech incubators offer company spaces, hackubators offer pre-company spaces — when it's just you and an idea, but you need the equipment and connections to biotech and pharma to get an idea off the ground," says Ryan Bethencourt, an entrepreneur involved in planning two biohacker spaces in the San Francisco area.

Several cities are encouraging the development of hacker spaces to create jobs and generate tax revenue. Joseph Jackson, co-founder of Bio, Tech and Beyond, got his organization's space essentially rent-free from the city of Carlsbad; in exchange, he is supposed to help launch eight companies within two years. He already has eight pilot users and 12 further requests for space. "If we can't make this model work here, it won't work anywhere," he says.

Brightwork CoResearch, a biosafety-level-2 facility for independent scientists, is set to open in August next to Rice University in Houston, Texas, home to one of the country's largest medical centres and a fledgling biotech community. Brightwork's initial funding comes from a stem-cell biologist and a local entrepreneur. There will be 20 benches dedicated to full-time researchers and another 20 for part-time researchers; almost one-quarter of the spaces have already been assigned. Most of the researchers hope to form companies, but sustaining their work won't be easy. "The big question is, how will groups fund their research," says co-founder Jacob Shiach. "The only thing that matters to me is that people are able to push the science they love forward."

"I don't want to give up doing science and I'm willing to go the distance to find a way to make it work."
Ethan Perlstein

Europe's budding biohacker scene includes La Paillasse in Paris: the continent's largest biohacker space, with more than 30 members, who pay what they can for the space (even as little as €2, or US$2.60) and use mostly donated equipment. Co-founder and president Thomas Landrain, a PhD student at the Institute of Systems and Synthetic Biology in Evry, France, says there are ten projects currently in development; at least three, including one focused on producing cheap ink from microbes, could become start-up projects. La Paillasse is growing rapidly and, with public funding and support from the mayor of Paris, will soon move to a larger building in the city centre, says Landrain.

INDEPENDENTLY WEALTHY

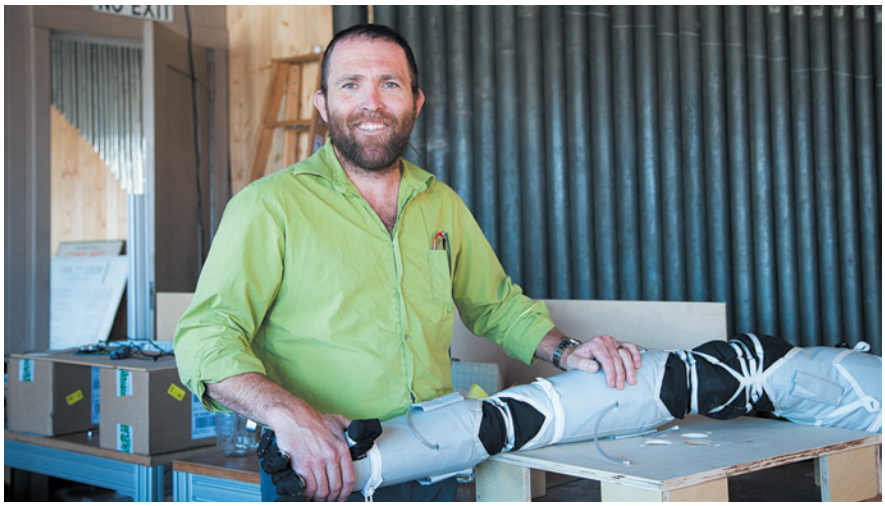
Once they have found a space for their work, scientists still need to find funding streams. That may mean taking on contract research, using crowd-funding to get enterprises off the ground or winning speciality grants, such as the small business innovation research grants from the US National Institutes of Health and the US National Science Foundation.

Saul Griffith is the co-founder of OtherLab, an independent research lab in San Francisco. His company gets roughly 40% of its revenue from grants to conduct early-stage, high-risk applied research on projects ranging from solar energy to robotics for agencies such as the US Department of Energy and the Defense Advanced Research Projects Agency. Another 20% is from contract research for companies such as Ford and General Electric. The rest comes from developing intellectual property and selling products — notably the OtherMill, a small, computer-controlled mill that can cut everything from circuit boards to jewellery.

UBiome — launched from the California Institute for Quantitative Biosciences, a start-up incubator at the University of California, San Francisco — gets its funding in small chunks by selling microbiome-profiling kits. For $89, it will sequence the genomes of the microbes living in a person's mouth, gut, nose or genitals. It gives individuals insight into their bacteria, but co-founder Zachary Apte also wants to mine the data to uncover insights such as how eating habits influence microbiomes. "I was ready to do my own research and had my own ideas to explore, but it takes a long time to get there taking the academic path," he says. His is not the only outfit funded by the public: earlier this year, three biohackers launched a crowd-funding campaign to raise the money to bioengineer a glowing plant (see *Nature* **498,** 15–16; 2013). They made just under $500,000.

A few funding schemes specifically provide early-stage support to high-risk, high-reward independent ventures. Shiach has just launched SynBio axlr8r, a programme to jump-start synthetic-biology companies with funding from SOS Ventures, a venture-capital firm in Kinsale, Ireland. "The goal of SynBio axlr8r is to take an idea through proof of concept to form a company within 90 days," he says. The first batch of 10–20 successful applicants will get US$30,000 each and a space at a science incubator in Cork, Ireland.

ANDREA DUNLAP



Saul Griffith funds his independent research in areas such as robotics using grants and contract work.

Through a scheme called Breakout Labs, the Thiel Foundation in San Francisco funds early-stage companies working on radical, big-risk ideas that are unattractive to federal funding and venture capital. Grants of $350,000 help recipients to reach technical milestones, at which point they can start to attract more conventional grants or investments. "I started a commercial enterprise because I wanted tools that didn't exist, to conduct my research," says Todd Huffman, who used a Breakout Labs grant to support 3Scan, an early-stage company that he co-founded to develop a knife-edge scanning microscope that simultaneously cuts and scans tissue slices to create three-dimensional models of samples. "I wanted to build these tools during my PhD and my adviser didn't think it was a good use of time," he says. Huffman dropped out of his PhD programme but maintains an interest in neuron morphology; after establishing 3Scan, he hopes eventually to return to his PhD with a new set of tools in hand.

Darren Zhu received a $100,000 two-year grant from the Thiel Foundation to leave university and become an entrepreneur. He is exploring ways to engineer organisms to produce novel molecules, a project that could help him to find a niche as the pharmaceutical industry continues to outsource early-stage research and development. "At this stage of my life, I can afford to take risks, to swing for the fences and see where it takes me," he says. In addition to his Thiel grant, he has money from the Bill & Melinda Gates Foundation in Seattle, Washington. He used it to buy lab equipment from liquidated firms, with which he has furnished an independent, industrial lab space in Mountain View, California.

OVERCOMING THE ODDS

Zhu says that one of the bigger hurdles of pursuing an independent path is that much of the biotechnology field still places a premium on "old-fashioned credentialling" — publishing work in prestigious journals or having done a postdoc at a reputable institution. It is a challenge, he says, but one he has overcome by securing high-profile grants and fellowships.

The first challenge that Perlstein encountered was finding a space that met his needs. He was intrigued by the mix of hobbyists and professionals in biohacker spaces but, in the end, they just did not work for his specialized research. The space he eventually settled on is comparatively pricy at roughly $2,000 per month — but it offers a fully stocked yeast lab that will allow him to hit the ground running, conducting the six weeks of experiments that he anticipates needing to develop a rapid yeast screen for rare-disease therapeutics.

Bethencourt is helping to plan the Counter Culture Labs hacker space in Oakland, California, which will provide lab space to at least 50 paying members from this autumn onwards. But, seeing the need for more specialized spaces, he has also co-founded a small therapeutics-focused hacking space, called Berkeley Biolabs, which is set to open this summer.

Perlstein notes further challenges such as finding insurance to cover mishaps at a rented lab bench. His biggest hurdle, however, may be determining whether his research will translate into a viable company — and whether he wants it to.

With funding and positions growing more difficult to find in academia, many more scientists may become willing to take on the risks. And biohackers looking to continue their work in the face of a dismal funding scene will ultimately form their own experimental units. "People are taking control," says Perlstein. "I don't want to give up doing science and I'm willing to go the distance to find a way to make it work." ■

Virginia Gewin *is a freelance writer based in Portland, Oregon.*

EUROPE

Boost for mobility

The European Commission (EC) has proposed a strategy to boost movement into and out of the European Union (EU) for students and researchers. In an initiative outlined on 11 July, some visa restrictions would be eased to help non-European scientists to enter the EU and stay for more than 90 days. Member states will respond to the directive by August. The strategy also calls for a January relaunch of the Erasmus student-exchange scheme, with a budget of €14.5 billion (US$19 billion) for 2014–20 — a 40% increase on 2007–13. The Marie Skłodowska-Curie Actions programme to fund international researchers will have €5.6 billion for 2014–20, but expects to recruit an extra 10,000 scientists with co-funding from participating countries, says EC policy officer Ragnhild Solvi Berg.

UNITED STATES

Second postdoc survey

In a follow-up to an influential study, the US National Postdoctoral Association (NPA) in Washington DC has launched a survey to gather data on postdoc pay and benefits, policies, services and demographics. Results will be out next year. In 2003, Sigma Xi in Research Triangle Park, North Carolina, along with the NPA and partners, ran the first US multi-campus survey on postdocs' work, goals and perceptions of policies and practices at their institutions. The results informed institutional and federal policy. Lorraine Tracey, chair of the NPA board, says that the current survey will provide longitudinal data. "This will illustrate for federal legislators and funding agencies how policies can effect change across the postdoctorate," she notes.

PUBLISHING

Retractions speed up

The number of retractions has risen in recent years in part because journals are acting more quickly, says a study in *PLOS ONE* (R. G. Steen *et al. PLOS ONE* **8,** e68397; 2013). R. Grant Steen of MediCC! medical-communication consultants in Chapel Hill, North Carolina, and his colleagues analysed 2,047 papers published between 1973 and 2012, and later retracted. Those published in or before 2002 were retracted in 50 months on average; later, retractions took 24 months. Data that seemed "too good to be true" may now slip by less often, says Steen. "There might be a tendency to confront the author."