ART & SCIENCE

edited by ALESSANDRO DELFANTI

THE ART OF FREE AND OPEN SCIENCE

There is no field of knowledge production in which belonging to an institution is as important as it is in science. Or maybe there was. The so-called ivory tower of science, from where scientists isolated from society would produce and distribute their knowledge to the people, has proven bogus decades ago.

PHOTO (CC) ALEXANDER KLINK

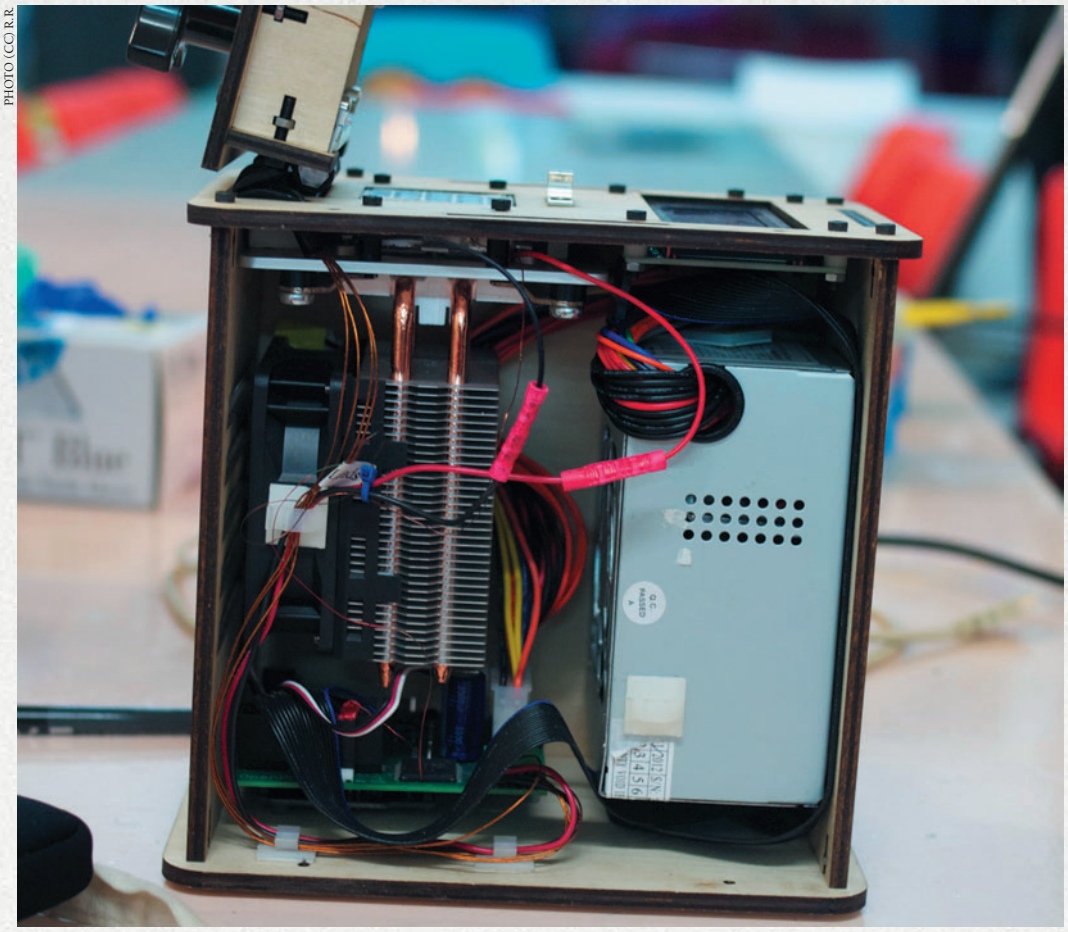
Meredith L. Patterson @ the 27th Chaos Communication Congress (the annual four-day conference organized by the Chaos Computer Club in Berlin), 2010.

We discovered science to be a very social enterprise, with all the problems, battles, uneven power distributions, links with complicated networks of other actors that characterize about any human activity Well, but if you do not have a Masters' and a PhD, and have not studied for years, can you be a scientists? Deciding who is a scientist, who knows, who can speak the truth, has always been an activity of primary importance. These discriminating boundaries are falling down, like the ivory tower's walls. More and more, people want to conduct experiments and have their say regarding the direction science is taking. More and more people want to be scientists even if they do not have any PhD. Technological and cultural changes are somehow putting science through the same type of transformations that art had to face in the past: the end of the elite control over cultural production. At least, this is how the enthusiastic claims about do-it-yourself science and biohacking present the emergence of a new movement of non-experts that is trying to build cheap and open source tools and infrastructures for experimenting and sharing scientific knowledge. Add the fact that biohacking experiences are full of artists who want to use active approaches to life in order to criticize the current system of life sciences research: this relation between do-it-yourself biology and bioart is very promising, as a cultural response to the domination of big corporations and transnational universities (what biohackers call Big Bio).

In this section we will present the changes that science is facing due to the emergence of peer-to-peer production models, in which free access to forms of horizontal participation guarantees that people can engage as peers. In one sense, garage biology is part of a well-known story: the emergence of online platforms for the open and collaborative production and sharing of information and knowledge. Garage biology is based on the same premises that allow the existence of an online distributed social production: cheap and diffused hardware connected to a distributed network (the Internet); collaborative software tools and services; broad availability of, and easily accessible data and information in the public domain; copyleft licenses that allow content reuse, modification and redistribution; a culture of participation. In fact, the diffusion of collaborative web tools and deeper transformations in the way science is conducted have given people new tools that enable a proactive approach to information production and to the shaping of the techno-scientific environment in which they live. But besides being part of a global change in the way knowledge is produced, science has important peculiarities. In this field, the rise of open collaboration involves blurring the boundaries between scientific experts and lay citizens: this is a problem of power that necessitates a transformation in the epistemology of the science expert. Citizens are more and more commenting, discussing, deliberating and producing scientific knowledge.

PHOTO (CC) R.R.

PHOTO (CC) R.R.



PCR Challenge / MadLab UK.

In this changing scenario, the emergence of do-it-yourself communities that work on biology and genetics is one of the most visible innovative stances. The most famous one is DIYbio, a community of biohackers established in Boston in 2008 and now represented by local groups in dozens of cities around the world. This so-called "garage" or "citizen" biology is conducted in odd places such as garages or kitchens. During the last two years DIYbio has become an important movement spreading all over the world. Interestingly, an important part of DIYbio is composed by bioartists interested in the political potential of the diffusion of biology to lay citizens. Some claim their use of open source tools, their relation with hackerspaces and their political attitude are important features that are shaping the way science is done in today's societies.

This makes DIYbio and other related projects a very interesting example of a direct translation of free software and hacking practices into the realm of cells, genes and labs. For example, their models are hackerspaces, collectively run spaces that are now widespread in Western and Asian countries, where people gather to hack, talk about and work on computers; spaces where community members that share the same political approach to computers or subscribers for a low individual monthly rate can find computers, tools, and other people interested in hacking. Sometimes, when they cannot open their own labs, DIYbio groups collaborate directly with existing hackerspaces in order to set up small labs, or "wet corners" among the computer hardware that fills urban hackerspaces. Some of their skills are acquired by working in "ghetto labs" in universities that were not well-funded. They recycle old machineries using free software and Arduino. They apply artistic creativity to hacking life science labs. DIYbio groups are also immersed in a dense entrepreneurial environment where start-ups and new open science companies try to navigate their way through the dominance of the Big Bio market. Will they be able to open themselves up to a more inclusive relation to citizen science? Well, if they won't, they might have to face rebellion, at least according to some biohackers. In her *Biopunk Manifesto* the hacker and DIY biologist Meredith Patterson pompously (and ironically) states: *we the biopunks reject the popular perception that science is only done in million-dollar university, government, or corporate labs; we assert that the right of freedom of inquiry, to do research and pursue understanding under one's own direction, is as fundamental a right as that of free speech or freedom of religion. The biopunks are actively engaged in making the world a place that everyone can understand. Come, let us research together.*

This process of de-institutionalisation is not free from political consequences. Critical Art Ensemble (CAE) has been one of the first protagonists of what is now the broad emerging movement of DIY biology practices related to art. In its contribution to this section, CAE presents the purposes of its participation to bioart, which are more straightforward than those of most other projects. CAE wants to take biotechnologies out of the hands of corporations and militaries, and repurpose them to work for the common good. Bioart, public experimentation, citizen science are tools to invent a new biopolitics, one that eludes the "agents of capital" control and their attempt at recoding life in their interest. Grassroots alternatives such as biohacking and DIYbio are at the core of a possible, different development of a global biopolitical ecology. In the second piece Sara Tocchetti interviews Hackteria, a global art network of people that practices what they call *open source biological art*. Their workshops have taken place in Europe and Asia. Marc Dusseiller, one of the founders of the collective, illustrates Hackteria's tactics to open bioart to anyone and to allow collaboration between artists, hackers and scientists. Hackteria's point is to enable people to collaborate, produce and share scientific knowledge without the support of an official institution. Both science and art, in their view, should be subtracted from elites' and experts' control. Demistification of science could be the by-product of open source biological art, as it gives lay people the tools for understanding and participating to the life sciences enterprise. In the last contribution we discover one of the weird places where communities of biohackers, artists and scientists collaborate on do-it-yourself biology projects. Eric Deibel's article focuses on La Paillasse, Paris biohacker community. Based in the outskirts of the city, La Paillasse is a physical space where biohackers' creativity can be expressed outside the walls of "big biology" labs. The availability of basic tools for conducting biological research, the adoption of open source policies, and the convergence of art and hacking practices make La Paillasse a great example of the cultural response to the Big Bio domination that biohacking wants to represent. Critical Art Ensemble ends its piece with an invitation to "the public lab". If we had more public labs, places where art, hacking and citizen biology converge and contaminate each other, more people would acquire specific critical skills to understand and interact with the life sciences. Or, in the worst-case scenario, we would have lots of fun. ■

Alessandro Delfanti

BIOTECHNOLOGY IN THE PUBLIC INTEREST

Two technological revolutions have fundamentally changed the world over the past quarter century–one in Information and Communication Technology (ICT) and one in Biotechnology. The former is far more celebrated, as it is such an essential part of everyday life for people in developed countries. Its impact is immediate and ubiquitous.

Service workers, bureaucrats, technocrats, business people, and students spend a greater and greater proportion of their waking hours looking into screens and taping on keyboards. Biotechnology is seemingly far less omnipresent. It appears to be far from everyday life because its development and production takes place behind laboratory doors, and are understood only by a specialized cohort of scientists. As we shall see, this understanding, while correct, is quite shortsighted. Critical Art Ensemble will even go a step further and say that while the revolution in ICT is far more spectacular, the revolution in biotechnology is fundamentally more profound and equally ubiquitous.

Critical Art Ensemble realizes that this is a very bold assertion, since even upon a cursory glance anyone can see how ICT has revolutionized the world. Most significantly, it has made possible a final form of capitalism pancapitalism, an economic hegemony that is truly global in scope. Interlocking and interdependent global markets are now a reality birthing global transnational institutions that operationally function under no authority but their own. Using the increasing virtualization of all dominant forms of human activity, whether we are speaking about economic exchange, warfare, entertainment, or even simple sociability, pancapitalism has managed to produce a globally dominant general ideology (neoliberalism) in which the categories of enterprise and profit become the lens through which all value is assessed. Given this spectacular, inescapable, ideological and economic envelopment made possible by ICT, how can it be anything less than the greatest revolution of them all?

Critical Art Ensemble believes that as with all spectacular phenomena, this revolution is reducible to the question of quantity. The ICT (digital) revolution ultimately brought us more of the same, but on a vastly larger scale. So while we haven't seen global empire, spectacle, or markets before, we have seen vast empires, spectacles, and markets. On the other hand, Biotechnology is not only vast in its many manifestations, it is also genuinely new. Beginning with quantity, biotech touches on everything organic, and thereby is also truly global. For example, its impact is continuous in the food supply chain. In terms of everyday life, the products generated through biotech are everywhere, from our kitchens to our medicine cabinets and our bodies and for a small group of people biotech is the reason they exist at all. But biotech's real significance has to do with quality.

PHOTO © MIKE MULLEY

Critical Art Ensemble.

Pancapitalism, like other power formations before it, has never been able to fully control human interiority. It can envelop the body and consciousness and try to push its imperatives into them, but it has never been able to control thought or desire with any reliability. Certainly, it has made great strides at pushing its way in, but no magic formula has ever been found to make people desire what they do not need, or serve without resistance. Even the simplest advertising campaign is never a certainty. It may work to displace desire from fundamentals typically hardwired into humans needs like food, sex, shelter, belonging, and alternate states of consciousness and onto superfluous items, but it tends to work only for brief periods of time and often fails altogether. The steady stream of focus groups that accompany advertising campaigns is clear evidence of capital's awareness of this uncertainty. Biotechnology can help to optimize this process, and not just through humans. It can greatly aid in the recoding of every organic system and every creature so they better conform to the imperatives of pancapitalism.

New advances in molecular biology have set this recoding of life into motion. To return to humans, those interior elements of consciousness we once thought inviolate are now open territory. The means to take the imperatives of neoliberalism and transform them into predispositions that could push outward to link up with the sign vectors pushing inward now exists. Given capital's propensity to optimize and rationalize everything it touches, we can be certain that the body's interiority is in its sights.

Capitalism has long shown its interest in engineering life, with perhaps no greater ferocity than in the eugenics movement of the early twentieth century. The desire to displace the blind, groping process of evolution and replace it with rationalized choices better aligned with the needs of capitalism has been an ongoing dream, and now the knowledge and the means to do it are available. Already many varieties of creatures are being recoded; however, serving the needs of power and selection for survival are two different things. Selection can only be speculatively understood post-facto, and thus cannot be engineered in advance, so we never know what kind of good or what kind of damage engineers are doing to a particular species or for that matter, an ecological system. Even if this problem were somehow avoidable (and given capitalism's record that would be surprising), we can be certain that capital is hoping to privatize life itself. A disturbing thought, and a reality already well underway.

In spite of these nightmarish tendencies that are the byproduct of neoliberalism, biotechnology could have utopian consequences. If it could be taken out of the hands of transnational corporations and militaries, it could be repurposed to work for the common good. For this to happen, biotechnology has to be reimagined and repurposed as something other than tools for the colonization of life, and that will only happen if those who are outside the immediate gaze, tutelage, or payroll of the agents of capital are willing to engage this challenge. (We should add that there are some scientists willing to assist biohackers in this endeavor, but they are not common.) The task is not easy, because participants will have to remove the blinders of enterprise and profit if they are to be successful. Moreover, they will need to participate in this activity in a manner that is beyond the pleasure of investigation and satisfying curiosity. Those who are able will have to frame the endeavor as a willful intervention against an unacceptable form of biopower or more positively, as a means to invent and deploy new forms of biopolitics.

It's not science, but it looks like science. The forms of biointervention and biohacking that have social value have little to do with producing scientific knowledge; rather, they are about producing a politics that stands in opposition to the recoding of life in the interests of pancapitalism. The production of scientific knowledge is out of reach for those who are not independently wealthy. Science is a capital-intensive enterprise that costs millions, often to produce only partial results. The cost of cutting-edge hardware is prohibitive (often because it cannot be optimized due to the low number of units sold), and the cost of wetware is no better. Biological reagents, micro liter for micro liter, are perhaps the most expensive substances on earth. Moreover, this endeavor requires a large community that has reached consensus on what constitutes legitimized process for cross-checking results for validity and reliability. In the overwhelming majority of cases, garage tinkerers are not going to be able to join this club.

Given these limitations, what can be done? To start with, if all one wants to do is explore the basics of molecular biology, that can be done in a limited (because of the cost of reagents) manner at a reasonable cost. One thing capitalism is very good at is optimizing popular products to bring the price down (unfortunately this seemingly positive practice is usually combined with the pilfering of the labor of the poorest, most vulnerable, and most desperate people on earth). Lab basics such as shakers, incubators, centrifuges, PCRs, precision pipettes, etc., are readily available and affordable for those who

have income to spare (particularly if you buy used equipment). Or, as Graham Harwood would say, *those without money can nick it*.

In addition, many processes have also been optimized, and in many cases come in easy-to-use kits. Labs are like any other capitalist workspace in that labor is thoroughly stratified. It's not optimal for the managers (PIs) to be doing lab work. They should be developing theories, inventing experiments, interpreting results, and writing grants. Cheap labor is what is needed, i.e., students, more commonly know as "lab monkeys". They need easy-to-follow instructions. What this means for interested biohackers is that without knowing the theory of what you are doing, a valid result can still be achieved (so no, you don't need a Ph.D.). Perhaps people want to know if their breakfast cereal is made with genetically modified corn there is a kit for that available at science supply stores. Just follow the very detailed instructions. However, you must make sure that your lab is outfitted correctly for the kit always check on what a given kit requires before purchase. The foundation is now laid : we can appropriate equipment, process, and limited amounts of knowledge, and turn them to our own needs.

Now we come to the creative part of our process. What can we do with modest means? To answer this question, Critical Art Ensemble's suggestion is to turn to the history of art for answers, and in this case to one the great culture hackers of the twentieth century Marcel Duchamp. Early in that century Duchamp produced a series of readymade sculptures in an effort to disturb and disrupt mythic beliefs about art, i.e., that humans call art into existence through a transcendental creative act that is beyond the social sphere. Duchamp believed that art had no transcendental or essential qualities, and readymades were his proof. He took functional, manufactured items such as a bottle rack or urinal and repurposed them as art. Believing that meaning is determined by situation rather than essence, he placed the objects on a pedestal, in a museum or gallery, and signed them. The interrelation between the space, the pedestal, the object, the signature, and the viewer all signaled the legitimacy of the objects' status as art, and as such, they were looked upon and treated as art. This reassembling of points of meaning to produce new relationships to common objects is the model that biohackers can use to produce new perceptions of, thoughts about, and relations to the organic world. (Or, as William Gibson writes, *the street finds its own uses for things…*) Biointerventionists need to find our own uses for the tools of molecular and cellular biology to repurpose them as decolonizing and liberating processes and objects.

With equipment and production models out of the way, we can proceed to explain why we have such faith in the amateurism of those engaged in DIY, rather than in specialists, to lead the way in repurposing the tools and processes of biotechnology. The primary reason is that amateurs do not have a conflict of interest. Their interests are their own, and do not have to align with corporate or military interests. As noted earlier, science is an expensive enterprise (and we do mean "enterprise"). The money has to come from somewhere, and only three sources are available: the military, the government, or the corporations. This means that research agendas must be aligned with the agenda of one of these institutions. For any of these investors to continue to funnel money into labs, they have to be getting a return (either monetary or symbolic). This puts scientists under constant pressure to show practical results. Knowledge is not enough; there has to be practical (profitable) application. Unfortunately, practical reality tends to drive research more than knowledge for its own sake, although some scientists have become skilled at hacking funding by disguising their research with a stratagem a popular tactic with researchers exploring space is to say their work will lead to a moon station. Amateurs are completely out of this loop, and can turn their attention anywhere. Amateurs have the potential for far more creative vision at an everyday life scale. They are not burdened with history, standards, collegial scrutiny, institutional survival, and socialization to lab life. They can reassemble and repurpose free of the disciplines' repressive mechanisms.

A pedagogical dimension is also a part of this alternative to the science of pancapitalism. Earlier, Critical Art Ensemble mentioned the problem of alienation. Biohackers can help to demystify molecular biology, by producing projects that demonstrate that basic knowledge regarding issues of application and deployment of biotechnology is available to and can be easily acquired by the public. If we fail in this initiative, biotechnological public policy will not be created through democratic process, but through the current oligarchic process, where corporations do as they please, by creating their own research and safety standards and then policing themselves. As with all alternatives to the rule of pancapitalism, they must come from the grassroots. So much is at stake at this moment in time. BioDIY, biohacking, biointerventionism, or whatever one wants to call it has a far greater charge than self-amusement through garage science, but has an important place in the development of a democratic biopolitics, future forms of life, and the health and diversity of the global ecosystem. Critical Art Ensemble hopes to see you at the public lab. ■

Critical Art Ensemble

Critical Art Ensemble (CAE) is a collective of five tactical media practitioners formed in 1987 and devoted to exploring the intersections between art, critical theory and science. The group has exhibited and performed at diverse venues internationally, ranging from the street, to the museum, to the inter net. CAE has also written six books. *In Molecular Invasion* (Autonomedia 2002) CAE offered a model for the creation of a contestational biology driven by active intervention in the organic realm. Web: www.critical-art.net/

Free Range Grain

PHOTO © CRITICAL ART ENSEMBLE

INTERVIEW WITH MARC DUSSEILLER

HACKTERIA

Could you tell me something about the history of Hackteria and how it is changing over the years?
The three of us met in Madrid during a large workshop organized by the Medialab Prado called "Interactivos?09: Garage Science", on how the open source and citizen science approach can change society During the workshop we decided that we need a type of organization and activities that will bridge the gap between the popular bioart practices and the emergent DIYbio/citizen science approach, and Yashas came up with this funny name Hackteria. We organized our first Hackteria workshop in Berlin on how to use DIY microscopy for sound interfaces. In 2010 HackteriaLab started a series of expert gatherings during which we evaluate what was done and establish new collaborations. Right now we have Urs Gaudenz in Lucerne working closely with SGMK on new workshops on laboratory infrastructure, then Brian Degger, who co-founded a Hackerspace in Newcastle, doing a lot of playful bio-experiments, then a DIYbio geek from Germany, Rudiger Trojok, who will move to Copenhagen soon to start organizing workshops in the local Hackerspace, BiologiGaragen, and Denisa Kera, who is starting some collaboration between Prague based Hackerspace, Brmlab, and the Hackerspace in Singapore.

Why is this focus on the world outside of the Laboratories important for Hackteria?
Rather than having just one citizen science laboratory like a typical Hackerspace, we developed a strategy of mobile labs, which can be installed and transported anywhere in the world: art studios, art centres, or even unexpected places like jungles or streets of Indonesia, where we have already performed and further developed some science experiments. The mobile labs help us understand how these future technologies will interact and influence our everyday life andpractice in very different contexts. Most Hackteria work is very process-oriented and open-ended, we like to improvise in new locations and with new people, which often results in unexpected, creative projects. Doing "science" and experimenting with technologies in the DIY manner on the streets, in the art centres or various other locations helps us understand what are the challenges and limits and how to create tools and processes that will simply enable more people to enjoy research and tinker around with "expert" knowledge.

Plant Smela.

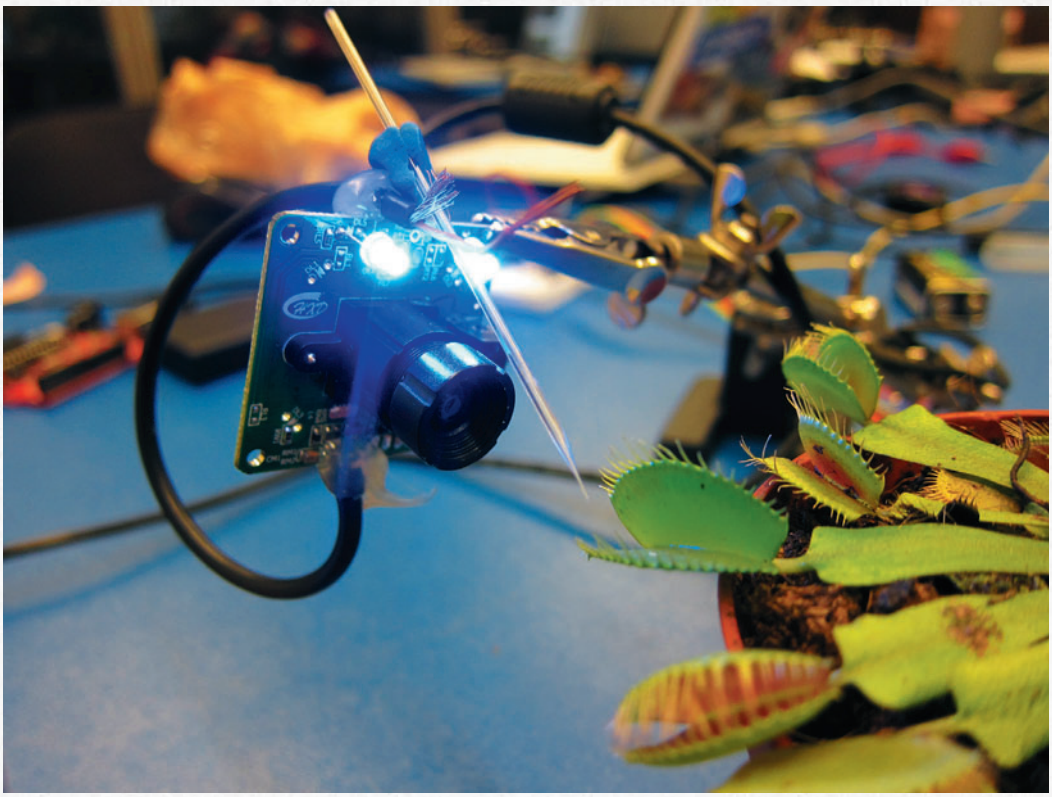


PHOTO © HACKTERIA WWW.HACKTERIA.ORG

Could you describe some recent Hackteria project, which embodies this type of vision and practice?
On our wiki you have over a dozen of people contributing and describing their ongoing projects, so right now there are over 45 projects starting with simple instructions on how to build a laboratory infrastructure to more sophisticated descriptions of lab protocols on how to work with different living systems. You can learn some basic DIY techniques of growing bacteria and algae or start your own microscopy project with a simple set of instructions on how to turn a cheap webcam or a Playstation3 Eye camera into a DIY microscope. The microscopy project is very popular but also useful not only for science amateurs and artists but also for people from the developing countries with limited access to expensive lab equipment. The microscopy project is also a good example of how we work, we like to hack consumer electronics and hardware to serve a new purpose. We transform these symbols of our enslavement to the media industry into emancipatory lab equipment, which can enable anyone to explore and observe nature, specifically the world of the microorganisms.

And how have you seen other themes and practices evolving during these years?
We are starting more projects in bioelectronix, but we will also continue our work with DIY

microscopy and synthetic biology. We would like to start experimenting with biofuels for which we are building a bioreactor to grow algae using an Arduino. Many of our members are still very keen on fermenting wines and even various gardening projects. The microscopy project will likely evolve into attempts to create a bioprinter to print fungi or bacteria. The laboratory tools, such as incubators, pipettes, centrifuges and others are still the core of our activities, because I think it is essential to be able to set up a laboratory wherever you are. During the last year I have been building simple kits for 'lab-in-a-box', a mobile biohacker suitcase. This January in Indonesia we even transformed a local street food truck into a semi-functional biolab, with which we performed simple scientific experiments with microscopes, sterilization, but also molecular gastronomy experiments like spherification.

PHOTO © HACKTERIA. WWW.HACKTERIA.ORG

Ars Daphnia Circus.

Could you explain what is Open Source Biological Art and how it relates to DIY biology?

Whether it is a wiki or a workshop or both doesn't really matter, what is essential is to enable people to collaborate and share knowledge and instructions. Open Source Biological Art enables people to perform complex scientific protocols without the support of an official institution. We believe that it is important to enable more people to feel confident in working with living systems in order for creative and new ideas to emerge. When applied to science and art, it can create a new type of public participation and understanding of both domains. Artists nowadays rarely share their precise instructions on how they did something. They simply think the documentation of their process is not important, and that the role of the public is to be just viewers, passive consumers and admirers of their works. In this respect, so-called bioartists are a little bit like scientists creating their own ivory towers. We think this is very old fashioned and actually wrong because it creates the wrong impression that both science and art are something practiced by certain experts and elites that will decide on our future. Our approach is radical, we believe that everyone should be actively involved in the future of biology and science, and that amateurs, tinkerers and hackers should have an equal access to the tools of art and science "production".

Why is it important to bridge the gap between artists and scientists and how it relates to the discussions on the relation between experts and lay people?

I am very interested in improving science communication and public participation in the life science. I would like to see a type of democratization of science, which involves citizens directly rather than leaving the whole discussion to some NGO, media or professional science communicators who will represent and mediate their voices. My hope is that by enabling more people to do science in their garages, kitchens and bathrooms, and by enabling more artist, designers and simply enthusiasts to work on various scientific projects, we will create a scientifically literate public, which can democratize decisions on stem cells, embryos, GMOs, nanotechnologies etc.

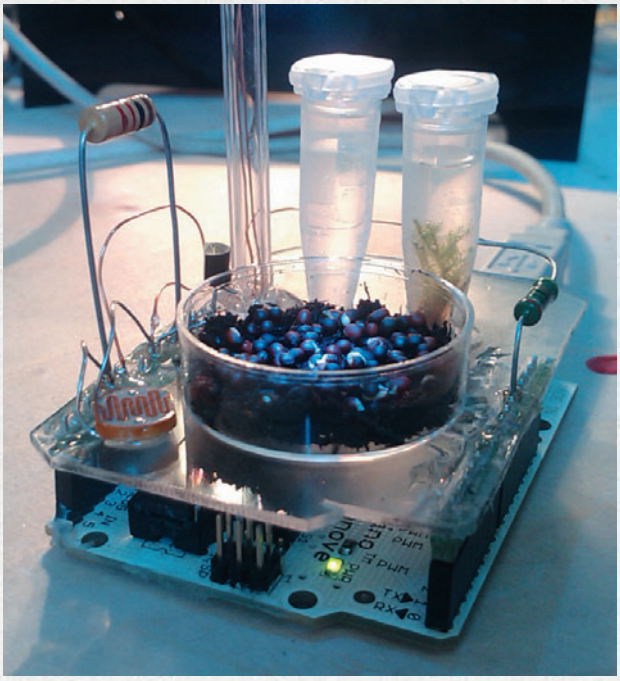
And what is your relation to the DIYbio scene? On what type of projects do you collaborate and how do you differ from them?

Hackteria was part of the global DIYbio movement right from the beginning and our activities were always overlapping. Two years ago when DIYbio.org was still starting I met Mac Cowell, the founder of the movement, and invited him to one of our summer camp, and we collaborate and help each other quite often. The difference is maybe that the DIYbio.org is more like a mailing list with many functions, while we are primarily a wiki with instructions on how to build things, and also we organize a lot of workshops and events, which are not that essential for the core DIYbio movement. Another difference is that they are much more science and business oriented while we engage much more with artists, designers and even philosophers. Hackteria's educational and wiki resources are essential in helping artists and designers to gain confidence so they can later go on any science related mailing list, pose more specialized questions and communicate with the scientists. The relation between Hackteria and DIYbio creates this nice synergy and opportunity to support unique collaborations.

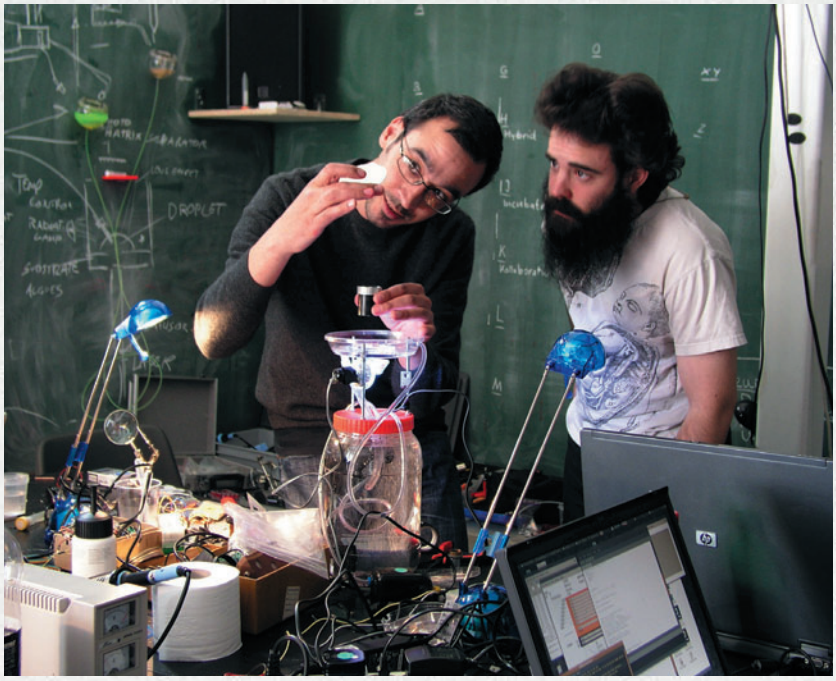
Could you explain how you imagine the ideal relation between professional scientists and citizen scientists?

When I visited Yashas in India for the first time, I realized how important is the DIYbio work we were doing in developing countries. There, science equipment is too expensive and scientific publications basically in-accessible. The Hackteria wiki enables students in these countries to gain research skills with some of the DIY tools we have developed, and we are constantly developing new tools. Many of our members are actually professional scientists, who took the DIYbio challenge seriously. They enjoy developing instructions and tools for people who for various reasons can't afford or don't have access to a professional lab space. DIYbio tools may never produce a cutting edge research but they play an essential role in the education of scientists and basically anyone who is trying to understand what is happening in professional science labs. DIYbio protocols and tools are means of science emancipation, a type of individual freedom and even right to develop your own, personal relation to scientific knowledge and to try new things, so you can make an informed opinion about such issues. Hacking stuff and making cheap tools to start your own laboratory and infrastructure will democratize science in this sense. It creates an opportunity for developing countries to improve their science education and research, which is meaningful to themselves and not to some peer review, Western journal, which is anyway inaccessible.

PHOTOS © HACKTERIA, WWW.HACKTERIA.ORG



Kresse Shield.



Working in Lab.

Who are the people who participate in your workshops?
It depends on the venue and the location. If it is a media art festival, the majority of the participants will be "technology and science oriented" artists and some engineers working on an art project but mostly those who don't have much experience with biology so they are reaching out and trying to learn something different in a friendly environment. Sometimes we also work with children. In India or in Indonesia we were also successful in attracting the local villagers and communities, and there we often work with some local organizations that have similar goals. In Indonesia there are organizations such as HONF (House of Natural Fiber) and Lifepatch.org that often involve local farmers and use some of the Hackteria methodologies, our DIY webcam hacked microscope, or protocols for making wine and fertilizers. Also Yashas is working with local villagers in India, teaching genetic manipulation and synthetic biology by using comics books, which speak to the general public.

Cyber Oechslemeter.

Tell us something about your personal projects under Hackteria
For the last two years I have been doing a lot of work in Slovenia on nanotechnology and biology with Kapelica Gallery, a prominent institution at the interface of art and science. We started with the NanoSmano project in 2010, which was a participatory public lab for experiments with nanotechnologies and their aesthetic potential. For two weeks a small group of science experts and artists were working on developing nanotech prototypes while the lab was open to the general public. With Kapelica we are also planning a series of workshops with children and we are setting up a mobile lab. I'm also active in Indonesia, where I have been organizing workshops for the last three years on DIY microscopy, fermentation, science outreach for local schools but also science and VJing events with the booming art scene. Meanwhile they started a new project called Lifepatch.org, a citizen initiative in art, science and technology with a wiki very similar to ours but in Bahasa, so we are cooperating on many projects. It is very gratifying to see how the network is spreading, mutating and interacting around the globe.

What is your view on the future of citizen science?
My hope is that if more people are making things with their hands and have this direct and everyday experience with scientific protocols, we can demystify science and open the whole decision making process to more people and opinions. I think this is the future society, where I want to live, a place where tinkerers and lay people find new and unexpected uses and functions of technologies and scientific knowledge, where they hack it and adapt it to their dreams and lives and don't wait for some big corporation or government to decide what is good or safe for them. Because I'm also working as an educator, I have the opportunity to see how the attitude to science changes with direct experience. I think scientific institutions should spend more money teaching people how to do science and open their labs to the public rather than pay specialized science communicators to do some PR campaigns, which only create more suspicions. ■

interview by **Sara Tocchetti**

Hackteria is a network of people practicing DIY (do-it-yourself) biology with an interest in art, design and interdisciplinary cooperation. The network was founded in 2009 by Yashas Shetty, Andy Gracie and Marc Dusseiller and now includes not only scientists, engineers and artists, as you would expect, but also philosophers, entrepreneurs, and even foodies and chefs. Hackteria operates on a global scale, and is based on a web platform and a wiki for sharing knowledge, which enable anyone to learn but also test different ways of hacking living systems. Hackteria is not based in a physical space, and its goal is to allow artists, scientists and hackers to collaborate and test various biohacking and bioart techniques outside the official laboratories and art institutions, basically anywhere in the world.
Web: www.hackteria.org

BIO-HACKING WITH LA PAILLASSE
ON THE ART, SCIENCE AND POLITICS OF DOING-BIOLOGY-YOURSELF

If the figure of the biohacker refers simply to those that are politically and aesthetically invested in technical practices at the interface of computing and (molecular) biology, then it should include the fledgling community of bio-hackers at La Paillasse.

PHOTO © R.R. > WWW.LAPAILLASSE.ORG

La Paillasse / Team

La Paillasse recently celebrated their inauguration in a suburb of Paris. Next to railroads and old buildings that evidently will be demolished at some point in the near future, their "do-it-yourself" attitude is self-evident when looking at the tools that are everywhere, either in use, under construction or lying around in parts. Of course most of the equipment is hardware of various kinds that has been gathered to create a "hacker space", but there are also some workbenches with microscopes, a centrifuge, a spectrometer, incubators as well as the more mundane vials, refrigerators and microwaves. Most of the equipment is old and might be considered obsolete. But make no mistake, this is no less a place of creativity as the iconic laboratories of "big biology"; it takes a lot of creativity and perseverance to set-up a laboratory for next to nothing and without copying the research agendas of "big biology", or attempting to become as similar as possible to inventors in white coats working in sterile and disciplined environment and using state-of-the art equipment.

Certainly, the appearance of 'doing-biology-yourself' at La Paillasse does not resemble the pretty images on the websites of institutes of excellence and corporations, but the question is whether a biological laboratory that is part of a sub- or counter-culture of hackers corresponds to a kind of creativity that somehow challenges the typical "wet-labs", as exclusive and asocial spaces. Specifically, there is its older sibling's exemplary reaction to the commodification of source code; where does the example set by free and open source software development lead when the object of curiosity is not solely the creation and modification of source code and the hardware it runs, but is about living and working with forms of life as knowledge, as a technological creation, as art and otherwise?

La Paillasse as a starting point....

Let's begin with some of the many thoughts going around at the Thursday evening meetings of La Paillasse. Of course everyone is welcome to join in with the diverse group of individuals who are passionate about developments in the life sciences. It is not necessary to distinguish who exactly might be identified as a life scientist, as a programmer or as a student, citizens or artists interested in social aspects of science. It is likely that those in attendance will end up identifying with at least a few of these figures in the course of the evening, regardless of their level of experience. This is also what "doing-biology-yourself" means. The barriers to becoming active in biology are extremely high; the knowledge required is about keeping track of the rapid pace of technical developments and mastering the skills and knowledge that are necessary to work with instruments, taking them apart and using them in experiments. In other words, DIY-bio focuses on the construction of a laboratory with basic tools for anyone with a basic attitude towards experimentation. This laboratory is actively being rendered as a social space that is as inclusive as possible.

Neurohack, **Psyche Delight** (performance) @ La Gaîté Lyrique, Paris 04/2012. Created by Sam NeuroHack, Katerina Saponenko & Franck Weber.

PHOTO © FABRICE DEUTSCHER

PHOTO © ARIEL MARTÍN PÉREZ > WWW.PAPIROFILIA.COM

La Paillasse / Team

Many of the examples being discussed at La Paillasse illustrate this. The thresholds to the participation in registering and cataloguing the interaction of biodiversity and genetically modified organisms are low. Of course this process requires tools that are able to do so and that are simple enough to make it possible for anyone to collect credible data. For example, La Paillasse has initiated a project about the properties of algae. Algae are increasingly the focus of an influential research network that investigates new biofuels. A sample costs little and with a bioreactor and some practice it is possible to generate electricity. Sometimes it is the simplicity of the technique and the proximity to materials encountered in everyday life that are important, like creating paper or simple plastics out of micro-organisms. Other times, however, DIYbio cannot be distinguished from BioArt. For example, the interaction with algae could also be transformed into music. Why not "listen to life" by developing software to record variations of sound and luminosity of algae-cultures? The result is then the recording of any change, generating sounds in response.

The digital domain inhabited by the hacker reappears in these kinds of projects. This reflects how only a few of the senses are being relied upon, while informatic ways of thinking about life, nature and the body emerge. For example, a simple headset with sensors could turn your brainwaves into different sounds and colours representing various aspects of mental activity. This is the so-called neuro-hack project. Similarly, many other meanings can be directly connected to the enormous amounts of information about genes, proteins, cells and so on produced by scientific research. To visualize the behaviour of complicated interactions of biological entities typically involves the eyes, like reading text or seeing a simulation; there are also ways of listening to sounds, and even music, in relation to its changes in form, shape and position.

The open future

The projects described above might be considered mostly symbolic of the figure of the biohacker and of the laboratory as a social space in opposition to the exclusivity of the life sciences. Similarly, the figure of the biohacker refers to the potential of fledgling groups to become an alternative to the speculative future of life as a technological creation that is imagined to be entirely under control. Of course projects realized by the participants at La Paillasse — or future projects they might be doing in case they managed to upgrade their laboratory — are likely to raise critical and political awareness around issues in biology. For example, their low-cost and low-tech alternatives are "free" as they are performing an operation of (re-)valuing creativity, playfulness and collaboration between amateur-experts of various kinds — especially when compared to the restrictions on the tools' usage — materials, and knowledge.

Indeed, this kind of combination of technological development, human values, and unrestrained deliberation might be considered urgent and necessary as countermeasures to the ecological risks, insecurities, and life forms that are "out of control" in their association with biotech's general approach to the modification of plants, bodies and the environment. However, these are values that are not necessarily the opposite of the production and use of scientific knowledge in the life sciences as an increasingly regulated and commercialized activity. The values of access, openness and collaboration are not always exclusive to experiments and research, wherein commercial imperatives have no place. Similarly the desire to scale-up their experiments implies a proximity to the hype and speculation that surrounds the solutions provided by life scientists to the shortage of food and medicine; the speculation regarding the rise of ecological catastrophes of various kinds, and the many different dystopian associations that are its mirror image.

The figure of the biohacker encountered at La Paillasse is refreshing in its aspiration to find another kind of development to emerge out of the intersection between computer science and (molecular) biology. What remains, however, is a balancing act involving this figure's relationship to the political-activist overtones of the term biohacker. What happens when the scaling up of biohacking projects and the inclusion of more sophisticated instruments –that would give them many more possibilities to act on, and interact with life forms—occur? Obviously there is a tension between the figure of the biohacker, the reliance on more and different types of resources and regulations, and the formation of an open network that would support a new kinds of research, collaborations, grants, policy-making, etc. A research agenda that refuses to go this route might end-up becoming alienated from the way things are done in the life sciences. The two sides the biohacker and those doing-biology-themselves will come back together at some point in the near future, having matured and having accumulated much more experience. Hopefully, this will be a future encounter that will include the prospect of turning laboratories into social spaces, where there is freedom for anyone to work with DNA in its various formats. ■

Eric Deibel

La Paillasse is located at 6 Rue Léon Geffroy in Vitry-sur-Seine, where biohackers meet every thursday.
Web: www.lapaillasse.org