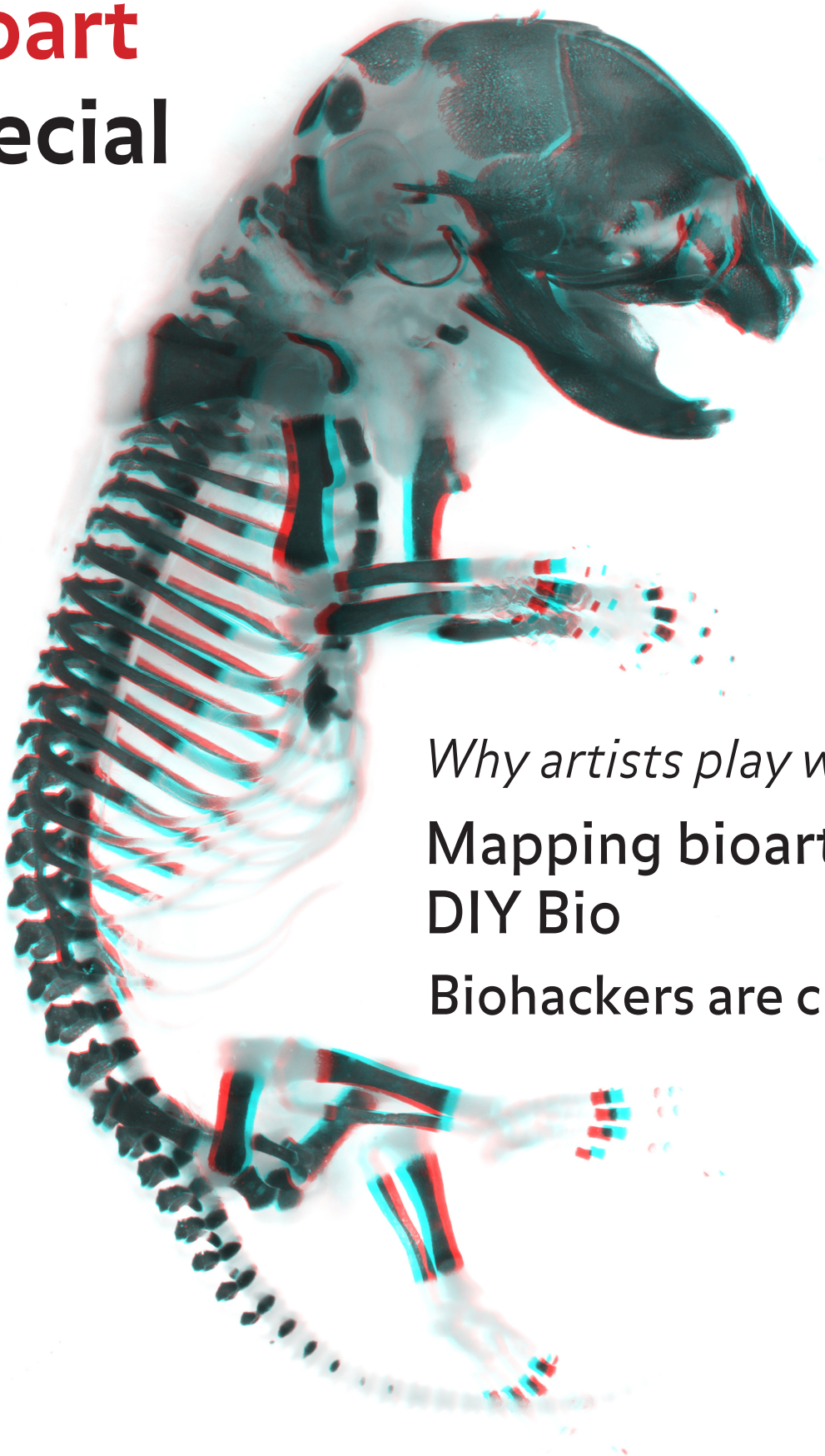
waag society

institute for art, science and technology

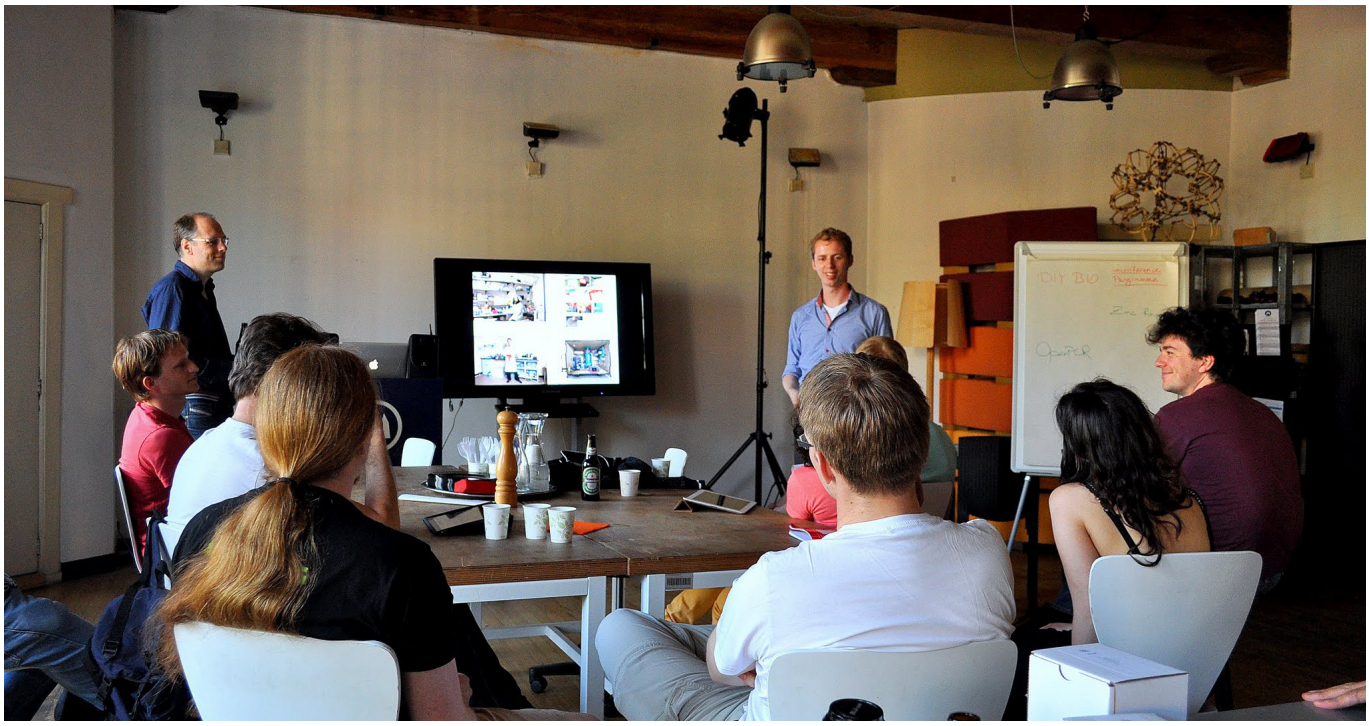
bioart special



Why artists play with life

Mapping bioart and DIY Bio

Biohackers are creators



DIY Bio session at the Waag in Amsterdam

Zaretsky:
"I want to offer people knowledge, so that they can overcome their fear of complexity and take part in the debate about new technologies and life sciences."

From: 'DNA in the kitchen' by Tracy Metz, NRC, 10 July 2009.

Wetlab and the design of life

Waag Society's Wetlab focuses mostly on the life sciences and biotechnology. The life sciences investigate living organisms, like plants, animals, and human beings whereas biotechnology is the use of living systems and organisms to develop or make useful products. The lab's main aim is to investigate how art and science can work together in producing new knowledge within this field. For instance, we want to find out in what way art might influence the scientific agenda.

A second goal of our Wetlab is bringing together scientists, artists and designers. And we are trying to keep politicians and the public involved by letting them participate in this scientific field; by organizing workshops, lectures or by inviting them to exhibitions. We want to enrich and stimulate the debate on the usefulness and desirability of the life sciences and biotechnology in our society.

With projects such as Designers & Artists 4 Genomics and Studiolab Utopian Practices, we promote the production of bioart because we believe that this form of art can be visionary and guiding for new prototypes and applications. Next to this, the work of bioartists can be a means to present scientific results to a broader audience.

waag.org/wetlab

wetlab
waag society

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Waag Society - Piet Heinkade 181 a - 1019 HC Amsterdam - waag.org

Meet Waag Society's Wetlab

INTERVIEW WITH LUCAS EVERS

Waag Society's Wetlab connects art and science, as well as life sciences and biotechnology, beyond their scientific context. We present you the Wetlab in nine quotes by Lucas Evers, who heads the lab.

Lucas Evers

"Art contributes to the social dialogue about life sciences and biotechnology, significantly more than scientists realise."

Bringing worlds together
"When art and science meet, unique connections arise. Scientists focus on factual knowledge production, whereas artists give meaning to this knowledge by connecting it to ethics, philosophy and aesthetics. Our Wetlab unites both practices, giving biotechnology and life sciences more relevance in a societal context."

Knowledge ecology
"I am interested in facilitating a form of knowledge production where artists, designers and scientists interact and where a multiplicity of languages arises. These collaborations provide us with new insights."

Maker culture and ethics
"The Wetlab promotes a 'maker culture' and closely collaborates with the Fablab Amsterdam; a place where people can realise their ideas and transform them into a prototype or product with the aid of high tech equipment. We stimulate a culture that makes the life sciences and biotechnology tangible and 'makeable' for a broader public. In our opinion this will lead to a deeper public understanding of technology and innovation. Consider it a version of the Milgram experiment, but without the coercion."

DIY Biology & Open Design
"We regularly arrange Do-It-Yourself Biology meetings, where we look at Low Cost Diagnostics. An example of this is creating an 'open' version of a PCR machine. A PCR can be found in every life science laboratory and replicates fragments of DNA in order to create a quantity that is big enough for analysis. Currently, everybody is able to create their own PCR with a simple manual which can be downloaded from the Internet. This Open PCR Machine costs a fraction of the market price and is available for a larger group of people."

Open doors
"The practice of life sciences often takes place in closed labs where an 'ordinary citizen' cannot enter. Thanks to bioart, this form of scientific research becomes open to the public and the media. Art contributes to the social dialogue about life sciences and biotechnology, significantly more than scientists realise. Since the Wetlab is an open platform, it reinforces the dialogue around the sense and nonsense of this research field."

Social and cultural innovation
"When designing a research project, people often look at new technological discoveries, whereas a lot can be achieved with Do-It-Yourself applications. Lex Peters for example is fighting cervical cancer by using household vinegar for the screening procedure and then treating the cancer spots by freezing them off with a metal probe cooled by a tank of carbon dioxide, available from any Coca-Cola bottling plant. This form of Low Cost Diagnostics is a great example of social and cultural innovation, which relates strongly to the DIY-community."

Bioart
"Art is a representation of reality, made with paint, rock or photographic material for instance. Why should science and its methods and means not be artists' material? Artists adapt this 'material', making new forms of art and influencing the general viewpoints on life sciences and technologies used in laboratories."

Dry
"Many times, our Wetlab is dry. For instance when we look at the possibilities to copyright or patent data obtained from research in bioinformatics and synthetic biology. We mostly do this together with the Future Internet Lab of Waag Society."

Safety
"All activities the Wetlab undertakes are safe and subject to the Dutch or European legislation. The Wetlab does not explicitly take a stand against genetic manipulation, but supports the active protection of biodiversity. As a rule we do not work with genetically modified material or pathogens, except under authorised circumstances."

Current and recent Wetlab projects

The Designers & Artist 4 Genomics Award
This award stimulates emerging designers and artists to delve into the world of bioart, and produce new work together with scientists from the most prestigious Dutch Genomics Centres in the fields of sustainability, food, health, bio-informatics, agriculture, and safety. The three winning proposals, selected by an expert jury, receive € 25.000,- each and are exhibited in their realized form at Naturalis in Leiden.
Designers & Artists 4 Genomics Award is an initiative of The Netherlands Genomics Initiative (NGI), the Centre for Society and Genomics (CSG) and Waag Society's Wetlab.

waag.org/da4ga

Studiolab – Utopian Practices
The goal of the project Studiolab - Utopian Practices is to reinforce cooperation between the arts and science in such a way that it involves a broader public.
By doing this, the project stimulates the public debate on the life sciences.
Currently,there are three projects that are part of Studiolab. In 'Towards a Solar Powered Species' Huub de Groot and Adam Zaretsky investigate the possibilities of creating species that survive on solar power. Rich Pell collects examples of species that are 'manmade' in his exhibition 'European Species of PostNatural History'. And in the project 'Trust me, I'm an Artist' Anna Dumitriu investigates the way art might contribute to the ethical debate about biotechnology.
This project is conducted in cooperation with The Arts & Genomics Center (TAGC) and the Leiden Institute of Chemistry.

waag.org/studiolab

PhDO.

From PhD to PhDO
Linking practical, hands-on knowledge to scientific research is of great importance for improving the quality and impact of creative work. Not surprisingly, designers, artists and decision makers in the creative sector feel the desire to add in-depth knowledge and tools to their own professional experience. However, there are many hurdles between this desire and it's actual implementation. PhDO connects people with the same ambitions to address these challenges and share experiences.
PhDO is an initiative of Waag Society and Arne Hendriks. Founding partners are NWO and IIP Create.

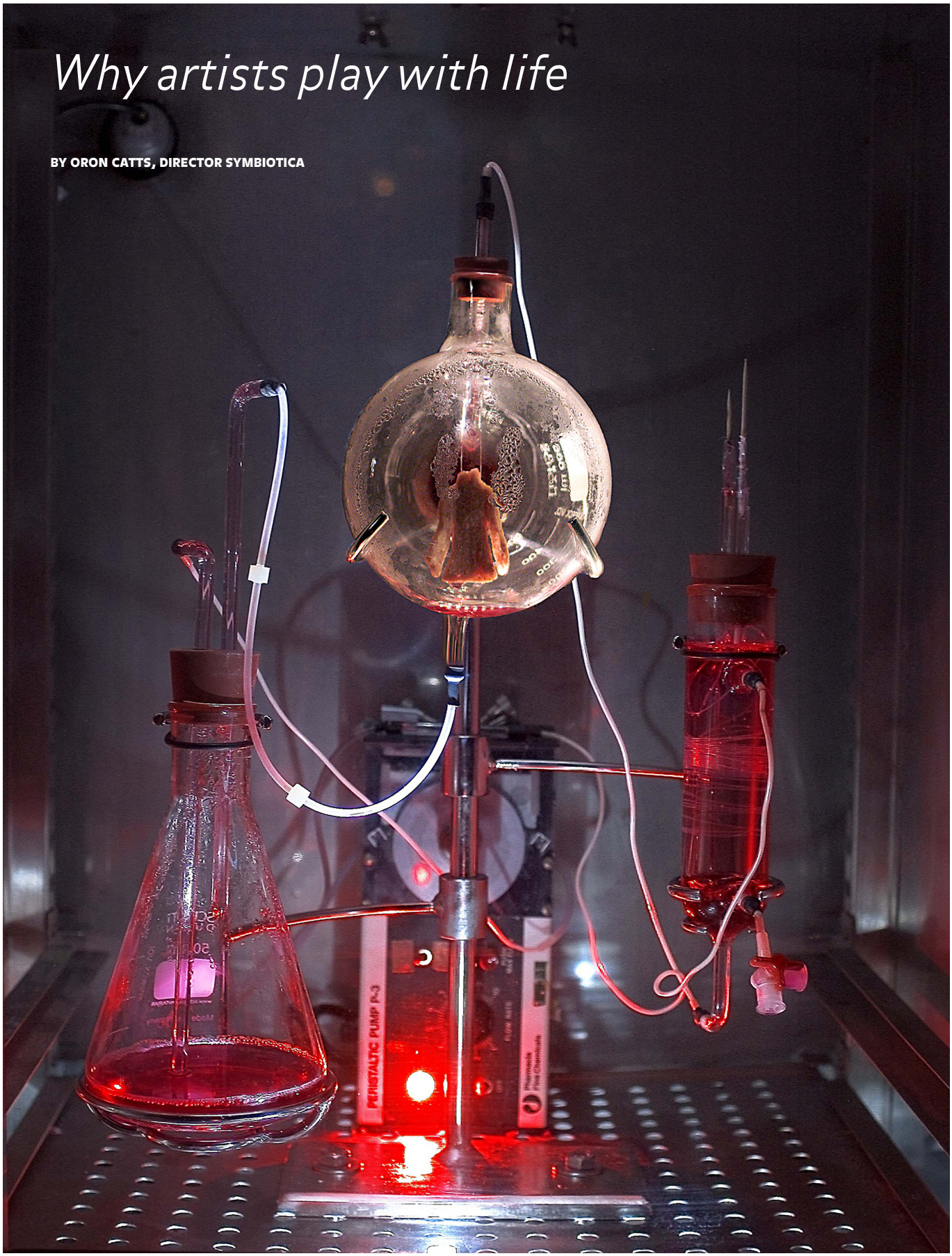
waag.org/phdo

VivoArts School for Transgenic Aesthetics (VASTAL)
VASTAL is a temporary research and education institute of Adam Zaretsky and Waag Society. Waag Society has invited Adam Zaretsky to be artist in residence over the course of 2009. During this period he conducted research and gave lectures on art and life sciences. Furthermore, within the framework of VASTAL, many bioartists participated in public 'art and life science events and debates'. Amongst others: Joe Davis, Oron Catts, Brandon Balengee, Teun Carelse, Jenifer Willet, Boo Chapple, Eduardo Kac, Any Gracie, Kira O'Reilly, Matteo Pasquinelli – urbanibalism, Marta de Menezes, Jennifer Willet, Ellen ter Gast, Huub de Groot and Rich Pell.

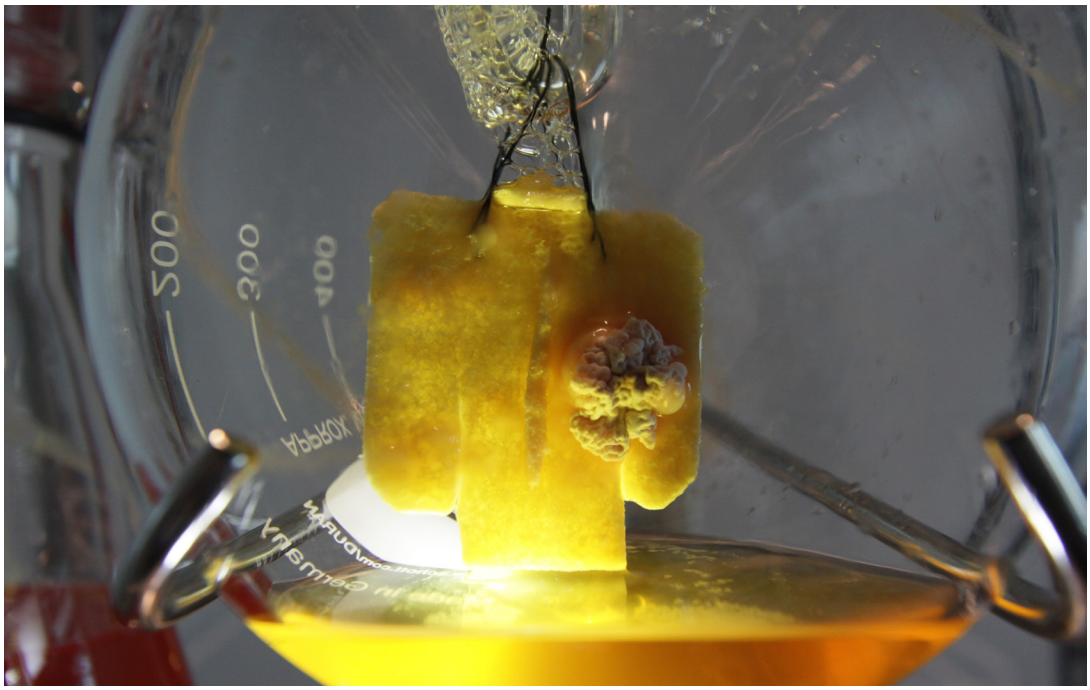
waag.org/vastal

Why artists play with life

BY ORON CATTS, DIRECTOR SYMBIOTICA



Victimless Leather- A prototype of stitch-less jacket grown in a technoscientific 'body' -
The Tissue Culture & Art Project (Oron Catts & Ionat Zurr), 2004



Disembodied Cuisine Installation Nantes France 2003 (Photo: Axel Heise)

The aesthetically driven and confronting treatment of life by artists creates an uneasy feeling about the level of human manipulation of living beings. This uneasiness seems to stem from a cultural and ethical ambiguity with regard to human engagement with life's processes. Our values and belief-systems seem to be ill prepared to deal with the consequences of applied knowledge in the life sciences.

Life is going through major transformations: even if it might be more perceptual than actual, contemporary life sciences and life engineering radicalise what we mean by life and what we can do with it. Through rigorous, critical and wondrous explorations in life science laboratories – artists start a dialogue about the potentials and pitfalls of our new approaches to life.

WHERE ART SHOULD NOT GO

Artists that deal with the theory, practice, applications and implications of the life sciences and biotechnologies contribute to this dialogue by creating a platform where alternative directions for the application of knowledge and technology are proposed. This can be seen as cultural scrutiny in action; articulating and subverting the ever-changing relations with life.

Much of the work of biological artists seems to be transgressive, trespassing into areas where 'art should not go'. As this type of artistic research is not scientific and is conceived, developed and executed as a cultural action, it situates itself and infringes upon very established demarcations. By using the tools of science and engineering, artists are questioning the professions' specific domination over processes and rituals. Things become even more contentious when both the subject and object of the artistic manipulation is 'life'; manifested through interventions with life processes from the molecular level, through cells, tissue, the whole organism, all the way to ecological systems.

LIFE IS WAITING TO BE ENGINEERED

The application of knowledge, acquired through directed research in the life sciences, seems to be driven by engineering logic and by the ambition to control life. Attempting such control may have always been the basis for human endeavours. However, our attitude towards life is changing, caused by the accumulation of scientific knowledge and technological capabilities. A choreographed interplay between hype and actuality is overlaid on a public that is bombarded with information that should excite and disturb, but is unfortunately also easily forgotten. As the perception of the level of control over the matter of life increases, life is becoming raw material, waiting to be engineered.

This concept of the single engineering paradigm proposes a future in which the control of matter and life would be achieved by applying engineering principals; through nanotechnology, synthetic biology, geo-engineering and, as some suggest, cognitive and neuro-engineering. One important aspect of applying this new engineering mindset to the manipulation of life is the notion that it would make bio-matter easier to engineer; and by that provide the ability of manipulating and creating new life by the uninitiated. As a result, life is becoming a new palette for artists, designers, hobbyists and amateurs. Artists and designers are already engaging with bio-matter in ways that were hard to imagine a few years ago.

MAKING OUR AUDIENCE UNEASY

As artists, we hope to have a different 'contract' with society – we ought to provoke, question and reveal hypocrisies through different tactics: whether through aesthetic, absurd or subtle confrontations. Allowing loss of control or 'engineering futility'; making our audience uneasy is an outcome of our own discomfort. All we propose to offer are contestable future scenarios different from the cannon of the contemporary trajectories.

About the author

Oron Catts is an artist, researcher and curator, working with art and biology since 1996, mainly as part of The Tissue Culture & Art Project (in collaboration with Ionat Zurr). In 2000 he co-founded SymbioticA, an artistic research centre housed within the School of Anatomy, Physiology and Human Biology at the University of Western Australia. Oron was a research fellow at Harvard Medical School and a visiting scholar at the Department of Art and Art History, Stanford University. He is currently the director of SymbioticA, a visiting professor of Design Interaction (Royal College of Arts, London) and a visiting researcher/consultant at Aalto University's Future Art Base, Helsinki.

Re-use of bio-information: some rights reserved or copyright?

BY THOMAS MARGONI

In nature, many DNA strain combinations and variations exist. These are mapped by technologies such as genome sequencing, the results of which are stored digitally. But who owns them? What happens once proven that they might have pharmaceutical or industrial applicability and become patentable inventions? And how can we protect the data that defines us as humans, without halting the development of science? Thomas Margoni (Institute for Information Law of the University of Amsterdam) explains.

When cell lines (once like computer code lines) were still cutting-edge experiments, sharing and free exchange of data were the default. Not just because there was no commercial interest yet involved, but because collaboration was the quickest and most efficient way to evolve. Similar to what happened in the field of Computer Science forty years ago, the amount of information we get from the life sciences, bio-informatics and synthetic biology is growing and more and more data is exchanged between companies and researchers in order to gain knowledge and do further research. When I look at the storage and sharing of this information from a legal point of view, I see a complex subject matter.

Biobanks and genetics databases are an emerging and fast developing phenomenon in genomic and proteonomic research, characterized by growing commercial interests and growing legal and contractual complexity. Computer and sequencing technology are powerful and extremely large portions of genetic data are produced and stored on big data farms daily. An incredible amount (terabytes) of sub-sequences of genomes (like Express Sequence Tags (ESTs)) are stored on computers worldwide. Such information looks like endless sequences of 'AGTCCTG'. A great extent of the scientific and commercial value of these ESTs lies in the 'annotations', or short descriptions, of their (believed) functions.

With the advent of new industries and markets strongly based on knowledge (after all we live in an information society), it is 'natural' that companies and corporations have strong incentives to control the future uses of the information they work with - such as ESTs – with property rights (copyright, database right, patents) and contracts (Material Transfer Agreements, MTAs). However, the authorship and ownership of this data is largely unexplored and varies significantly depending on the jurisdiction we are looking at. This only exacerbates the tension that scientific evolution

Copyleft sign - image courtesy of Margarita Benitez

is suffering, which is finding a balance between openness and closeness. On the one side, there is a basic set of knowledge that needs to be freely available for use and reuse by anybody. On the other side, funding needs to be attracted in order to make more expensive projects possible. To get this funding, the data needs to acquire economic value and be usable as a 'trading good'. A harmonised level of protection needs to be found so that any legal system can offer the most appropriate legal tool, making it possible to implement contractual instruments that offer a balanced approach. A balance that allows public and open access to biotech information, without frustrating the private sector system of incentives.

A study on this aspect will be fundamental in order to understand under which conditions the information can be licensed, whilst still allowing a wider range of uses and reuses. Therefore, open models in the biotech sector are needed as never before.

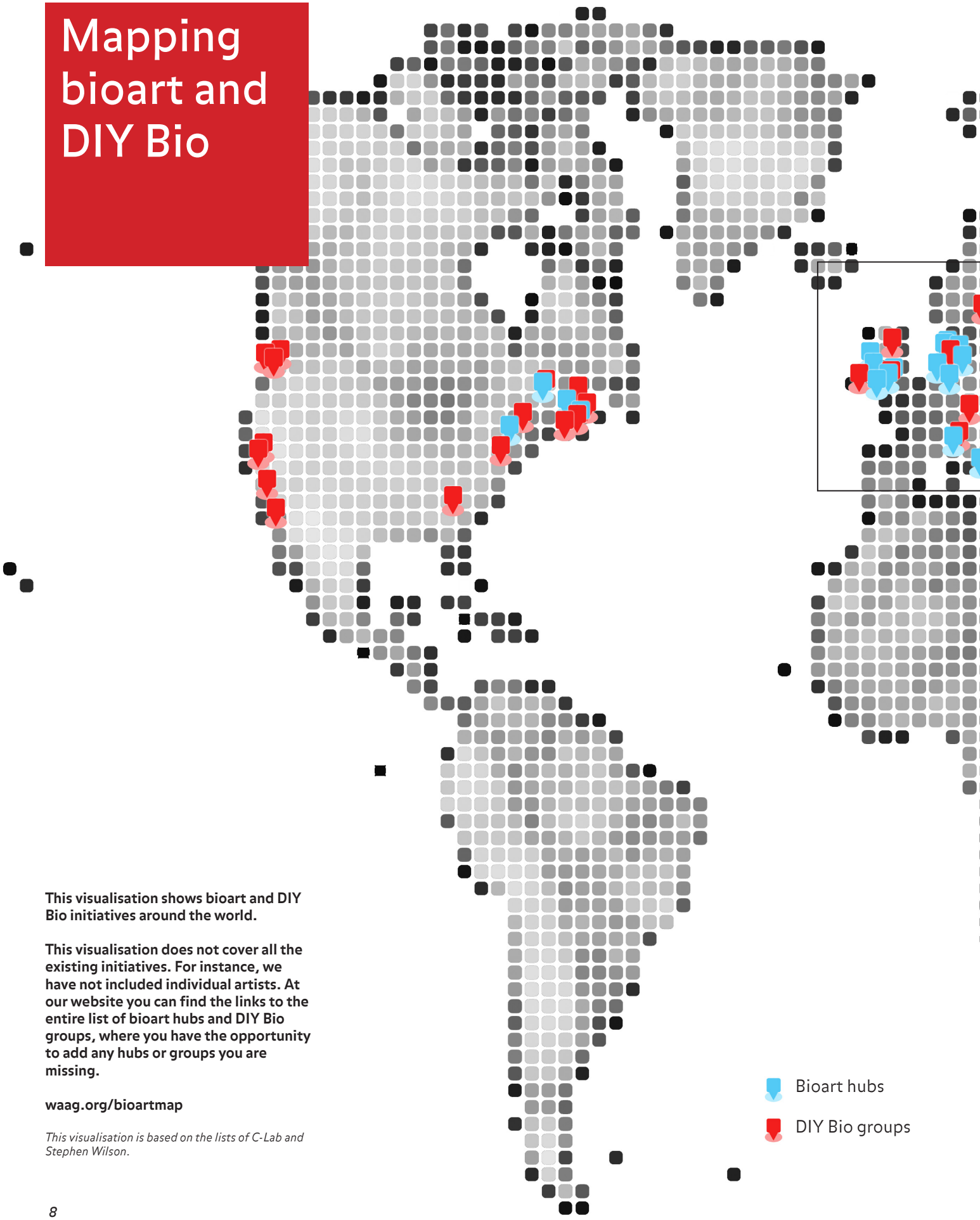
Once the ownership status of bio-information is clarified, not only transaction costs will be lowered but access and reuse will grow. Researchers will be able to mine the terabytes of genetic data stored everyday, without fear of copyright or sui generis (database) rights infringement, enabling the development of new knowledge out of existing information.

About the author

Thomas Margoni is a senior researcher at the Institute for Information Law (IViR) at the University of Amsterdam. Thomas has researched, taught and published extensively in the field of intellectual property, information technology and biotech law.

IvIR is part of the Netherlands Creative Commons (CC-NL) together with Netherlands Knowledge Land and Waag Society. CC-NL will studies the reuse of bio-information and its licensing models applicable.

Mapping bioart and DIY Bio

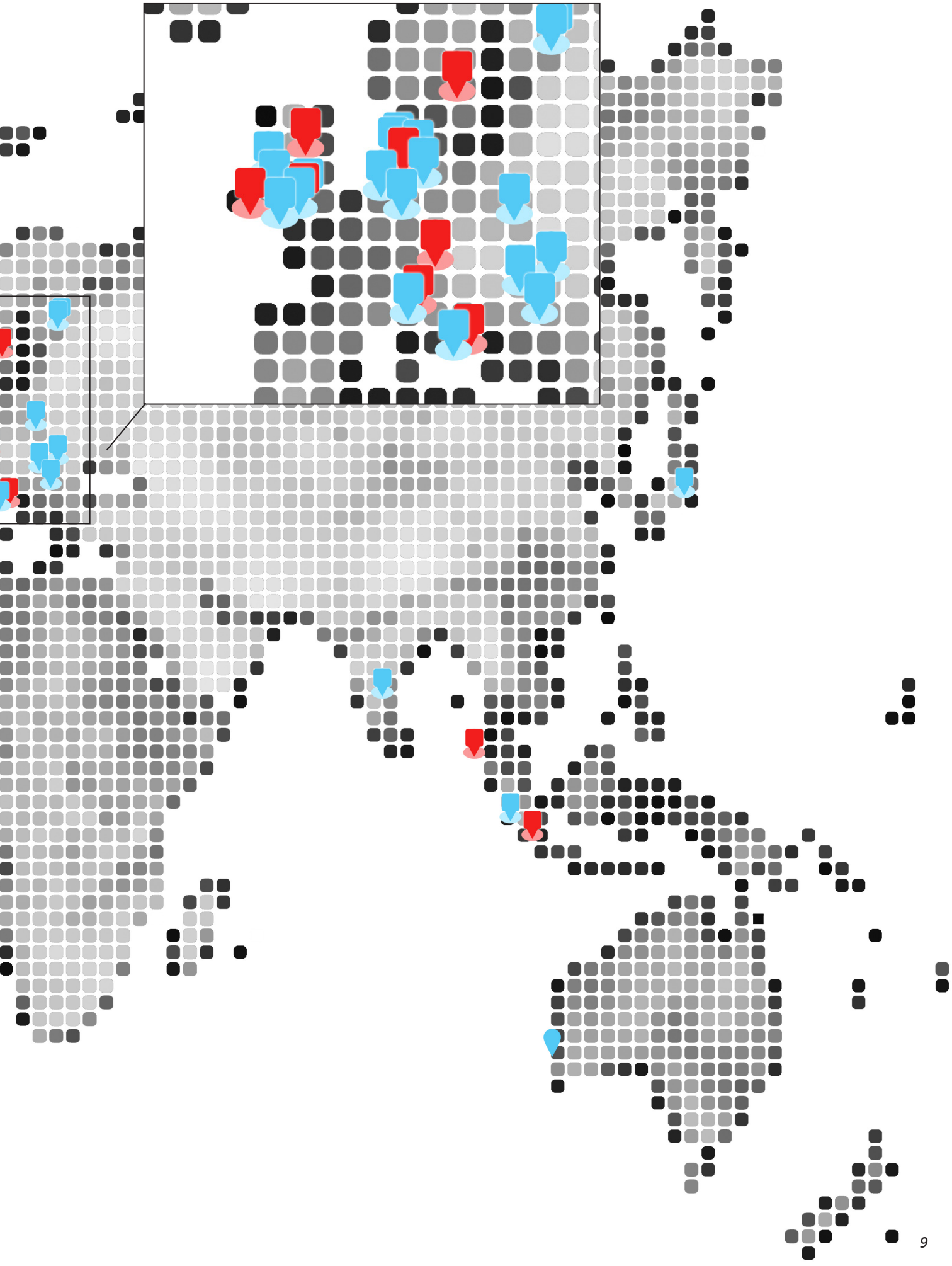


This visualisation shows bioart and DIY Bio initiatives around the world.

This visualisation does not cover all the existing initiatives. For instance, we have not included individual artists. At our website you can find the links to the entire list of bioart hubs and DIY Bio groups, where you have the opportunity to add any hubs or groups you are missing.

waag.org/bioartmap

This visualisation is based on the lists of C-Lab and Stephen Wilson.



Bioart: performance in transformation

BY ROBERT ZWIJNENBERG

VASTALproject by Adam Zaretsky (photo: Regine Debatty)

Developments in the life sciences can have major implications on our daily lives and our society. Think of genetic screening, predictive medicine or human enhancements that affect our views on health, mortality or human suffering. These developments also have economic and financial consequences. The life sciences are increasingly leaving their mark on our ideas about who and what we are, and what we want to remain and become. Thus, it is not surprising that a growing number of artists focus on life science in the so-called bioarts. How they do this, is a question that in itself needs studying.

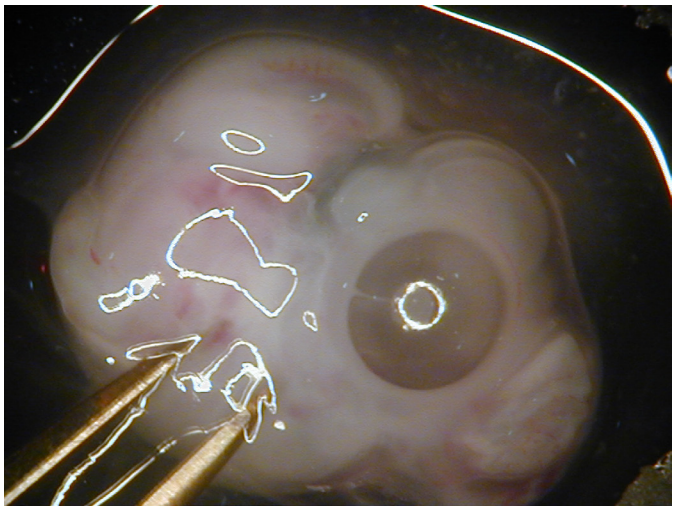
Robert Mitchell (Seattle, 2010) distinguishes two artistic tactics used by bioartists. In the prophylactic tactic, artists use 'non-biotechnological media such as drawings, sculptures or photography to re-present aspects of biotechnology'. Vitalist bioart on the other hand, is art produced in the laboratory using biotechnical materials and tools (DNA, tissue, blood, bacteria or higher organisms like mice, butterflies and rabbits). A common feature of the latter is the ethical dimension it raises because of the used materials and the surroundings in which it is created. Moreover, vitalist bioart is often produced in collaboration with life scientists, which means that artists have to follow the lab-rules and procedures.

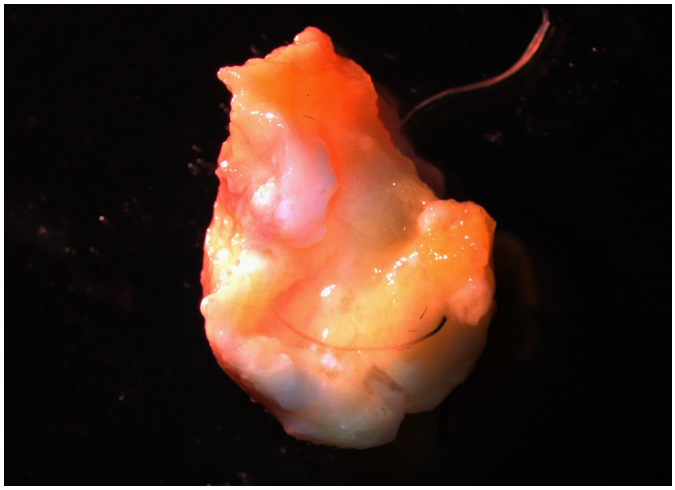
THE PARADOX OF BIOARTS

With these tactics in mind, several questions about bioart arise. Is it acceptable for artists to do the same as life scientists and do equal ethical standards apply? Can artists bear the same responsibility as life scientists for their use of living materials? Why is bioart a form of art if it merely repeats what life scientists are doing? And what new elements does bioart bring to the public and academic debate on life sciences? Trying to answer these questions poses us with a paradox: artists need to adopt some form of critical distance, which might become impossible if they have to follow the same rules as scientists and if they cannot do anything that life scientists may not do.

TWO-HEADED ZEBRAFISH

In his project 'Two-headed Zebrafish-embryo', Adam Zaretsky cuts of the head of a Zebrafish-embryo and tries to attach this to another embryo. The project takes place at a MIT-lab using standard techniques and following the ethical procedures of the lab. The project raises questions about whether an artist may do the same as a life scientist and it creates





Above: work of Adam Zaretsky: Two-headed fish embryo

About the author
Robert Zwijnenberg is professor of Art History in relation to the development of Science & Technology at Universiteit Leiden. His research focuses on the impact of art on science and technology in contemporary culture.

a platform for debate about ethical practice in the life sciences. At first sight we seem to encounter the paradox of bioarts here again. However, Zaretsky circumvents this paradox by apparently welcoming, rather than rejecting, biotechnological innovation and the creation of new forms of life: a Zebrafish with two heads.

Though the project reveals the gap between lab ethics and everyday ethics, in the work itself Zaretsky probes the boundaries and implications of lab ethics. The strength of Zaretsky's project lies precisely in the fact that the view of the artist is a view from the inside. By literally participating hands-on in biotechnological practice, he is able to explore and expose the ethical and aesthetic limits of this practice: the hidden desires, the concerns and the expectations.

In his work Zaretsky does not create a commodity. The material and non-material result of the work only have function and meaning in relation to his interventions in the lab, to his performance. A performance cannot be commodified into a tradable object, because it is disruptive and ambiguous, and above all ephemeral. The answer to the question of how art produced in the lab can have transformative force within the system of rules and procedures of the lab thus appears to be: through performativity.

REFLECTION AS AN ELEMENT OF BIOART

In practice this means that bioartists have the difficult task of acquiring a large degree of freedom within a lab without violating any rules. Off course, an artist can work in his or her own artistic lab. But this means that any transforming force of an artwork produced in such a lab will be neutralised from the outset, by the fact that the artistic lab is outside the sphere of the life sciences. Another solution is to guarantee the independence of an artistic project that is performed in a lab by having it assessed by an ethics committee beforehand. The obvious danger here is that any transforming force will be weakened in advance by fear of breaking the rules.
In my opinion, these solutions do not benefit bioart. This artform rather needs constant reflection on the ethical dimensions and paradoxical nature of the specific methods and location of production. Such reflection must be incorporated into the bioart-project itself, giving it urgency and relevance as art. Only with this reflection, form and substance can be given to a specificity that distinguishes vitalist bioart as a practice from biotechnological practice, allowing it to retain its transforming force within that practice.

Bioart under a microscope

INTERVIEW WITH HUUB DE GROOT, COLJA LAANE AND MARLEEN STIKKER

What happens when you put bioart under a microscope, by asking three influential connoisseurs poignant questions about the field? Read how Colja Laane, Huub de Groot and Marleen Stikker think about the latest developments, achievements and opportunities of bioart.

Project Aqua Vita by Susana Cámara Leret en Mike Thompson (DA4GA)

Why bioart?
Marleen: Biotechnology, as all technology, determines our society. Biotechnology is fundamentally the design of life, not just the discovery of life and how it works. In the essence it is about us all, although it is often isolated. At Waag Society we create joint responsibility by bringing art, science and society together with other disciplines. Artists ask different, more disruptive, questions in their search for meaning. When designing new life we need to address these questions to achieve results and to create acceptance. After all, it is about the design of humanity.

Colja: Most art is made from dead materials like wood, stone or paint. Quite strange, because the inspiration for art often comes from life. Bioart brings design, art and living material together. Next to this, bioart distinguishes itself from other art forms since it is perishable and temporary. Which is beautiful, but also risky. If Rembrandt would have worked with biological material we would not be able to look at his paintings now.

Huub: Bioartists show us contradictions and ambiguities: an essential phase in cultural development. By doing so they make room for interpretation. Their work has an element of confrontation with the current norm. However, bioart is not the same as propaganda – because art is timeless and does not manipulate. The artist takes responsibility for his art, questions in anticipation of future acceptance without taking a definitive, normative stand. Thus, bioart is a legitimate, socially acceptable and humanitarian way to open up the discussion between two different worlds.

What does bioart bring us?
Colja: Art should evoke emotions and move people. This applies not only to bioart but to all forms of art. Thanks to recent technological developments, bioart becomes more accessible for a large audience.

Marleen: Bioart opens up worlds and prevents scientists as well as artists from getting tunnel vision within their own disciplines. We need to share responsibility for research and innovation. Bioartists, designers and scientists have a pioneering role here.

Huub: Bioart opens a dimension in the cultural and societal development that is otherwise barely accessible. The broad-based need for a sustainable society makes this very valuable. There is an economic and cultural separation in our society for which a new form of dialogue is needed; historically, the social and human sciences have proven themselves incapable of engaging this dialogue. Bioart is capable of breaking this deadlock with the 'probes for debate' principle described by Marshal McLuhan; this makes society part of technological developments.

Does bioart offer opportunities to science and technological development?
Colja: Not necessarily, but it does create opportunities. Bioart offers new insights and interconnects scientists and artists. Look at the example of Jalila Essaïdi and her spider silk; this was born out of serendipity. It is a result no one was looking for, but it was found thanks to the collaboration. This serendipity arises by bringing parties together and the results would be impossible to conceive in advance.

Huub: Yes, scientists know their own individual limitations. For many scientists, it is a challenge to associate with a hedonist context, prevent market failure and develop the technology to create a more homogenised society without creating a division between groups with economic and cultural possessions. Bioart independently offers room for interpretation of societal developments, preceded by putting in motion technological development with which redundancy in science and technological development can also be avoided.

Marleen: Bioart is about shared responsibility and asking the right questions. In the classic perception, the public and the arts act as a correcting factor on the sciences. This is not what it's about – ideally we want a society in which artists and citizens are at the base of scientific research. So they get the means to produce knowledge themselves. Artists and scientists challenging each other and working side by side. Like Oron Catts, who asked himself and scientists: "Can I eat meat without feeling guilty?" Scientists

researched the possibilities of producing food to fight the growing shortage. Both parties are working towards the same goal. A great example of how asking a subjective question might lead to an objective contribution to science and innovation, obtaining knowledge in the process.

Jalila Essaïdi's project '2.6 g 329 m/s' with bulletproof skin has moved a lot of scientists; Susana Camara Leret and Mike Thompson were asked by TNO to continue working with them as a result of their project Aqua Vita; several artists from the international field of bioart work on the BioSolar Cells programme. Can artists and designers play an essential role in scientific innovation and valorisation? If so, what is that role?
Colja: This is a learning curve. Bioart has not been in the public eye for very long, just as our award (the Designers & Artists 4 Genomics award, EJ) is still very new. This means that many things will have to be explored and surprising effects can occur. By having artists and scientists working together we sometimes suddenly have a huge breakthrough or big revelation, but just as often this doesn't happen. It is unpredictable, which is exactly what makes it so fascinating. I don't think every lab will 'employ' artists anytime soon. Because of budget cuts unfortunately everyone retreats to their own corner. Hopefully we can continue to stimulate cooperation.

Huub: Apparently the artists in these examples inspire scientists. From my own research environment, the BioSolar Cells project, I observe that the curiosity of scientists is aroused and that they appreciate a fair competition with the artist and simultaneously take the liberty to keep a certain distance. They use the interaction with the artists for their own ideation - on a higher level of abstraction. It is of importance that they question their own aesthetics when it comes to their research, and they prefer to do this in contemplation rather than by taking it outside. A proactive role of the artist in this is certainly very productive; notably bioartist Adam Zaretsky interacts with scientists rather well. I myself experiment in a field that Zaretsky brought to the public: solar powered fish. We look at how artificial symbiosis and postnatural speciation benefits society – with a focus on sustainable energy. Surprisingly, the public does seem to appreciate the open discussion that we create together with the artist about how we should do this,.

Marleen: When art and science join forces, we can distinguish four different positions. Art can be a tool for science communication. Secondly, artists and scientists can work together but have their own output. They each tell their own story, simultaneously. Thirdly, artists can be at the base of scientific research, like the example of Oron Catts. And last but not least, the interaction with the public comes in: participation. I consider the DIY Biology movement as very promising.

Are you enthusiastic about developments like DIY biology, bioart awards and the attention they get?
Huub: Yes, very much, because it enables me to see if scientific developments are socially accepted in an early stage, and eliminate the dogmatism of scientific fields when infertile. Last but not least, I can seize the opportunity to demythologize science and disseminate knowledge for a sustainable society.

Colja: I am very pleased about the cross-contaminations that take place. To be able to look beyond borders is amazing. The life sciences are composed of many players, who often work in large teams on projects or subjects. It's good to see that artists and designers are becoming stronger stakeholders in this story. For it is at the intersection of disciplines that new things see the light. I hope we can continue what we have started - Waag Society, Naturalis and NGI, in a unique collaboration, have set something in movement with DA4GA.

Marleen: Bioart and DIY Biology turn the public into producers, not just consumers. Artists and scientists sometimes feel their work is sacred, thus creating a divide between them and society. We need to translate their work to make it relevant and understandable for society. Together with our partners we do so by making people part of the development; via social media, DIY projects, events or publications. I am glad to see art and science stimulate each other. Competition is fierce within the life sciences; it is great to see scientists make the time and take the opportunity to collaborate.

About the authors
(Photo top right) Prof. Dr. Huub de Groot is head of the Department of Solid State NMR (Leiden University) and conducts research about proteins in membranes. He leads an investigation into the photosynthetic system and how this might artificially contribute to our energy supply.

(Photo bottom left) Colja Laane graduated in Biochemistry from the University of Groningen and did a PhD in Wageningen. He has an extensive career in biosciences at DSM, Quest International, Unilever Research and as a professor in Biochemistry at Wageningen University. From April 2008 he is director of NGI, a consortia of 16 public-private partnerships in the area of genomics. He is (co)author of over 120 papers and about 20 patents, most of which are in the area of Industrial Biotechnology.

(Photo bottom right) Marleen Stikker is president and co-founder of Waag Society. As 'mayor' of the 'Digital City' (DDS) in Amsterdam, she developed the first free gateway and virtual community on the internet. In 2006 she started the annual PICNIC Festival together with Bas Verhart (Media Republic). She is a member of the Board of Advisors of ICT Regie, the IT organisation that advises the government in matters of IT and innovation and is a member of the Board of Directors at WPG Publishers, an independent publishing group in the Netherlands and Belgium.


"The mere fact that you are carrying out a project in a DIY environment creates new challenges."

Biohackers are creators

INTERVIEW WITH PIETER VAN BOHEEMEN

Within Do It Yourself (DIY) biology everything evolves around making biotechnology accessible, open and available; a process also known as biohacking. A golden opportunity for Pieter van Boheemen, project manager at Science Alliance: "Now that I have a desk job, going to a lab to experiment seems impossible at times. That's why I was pleasantly surprised when I discovered DIY Biology."

Building a PCR at DIY Bio at the Waag

As a DIY Biologist you make everything yourself. Aren't you constantly reinventing the wheel?
"The first projects of many DIY biologists are indeed replica's of what has already been done in a 'real' laboratory. But the mere fact that you are carrying out a project in a DIY environment creates new challenges. Different questions and answers arise. We don't just do things again, we do them differently."

And this makes DIY biology innovative?
"Absolutely, combined with the fact that DIY biology is not about 'usefulness' but about the experiment itself. This gives people the freedom to do something different from what large companies are doing."

Like your own battle against Malaria?
"Exactly. Together with Jelmer Cnossen and Wouter Bruins I am working on a device that can be used for Malaria diagnostics: the Amplino. We specifically target this disease because there is a lack of diagnostic materials for it. The machine we are making can be found in every Dutch hospital and lab, but our version is cheaper and can also be used in low-tech environments. We're developing it in our free time and at our own expense but we do want to comply with the design requirements of the World Health Organisation. For instance, the device has to work in areas where there is no water or electricity, as well as in high temperatures and humidity. It has to be robust and someone without or with minimal training should be able to use it."

Will the Amplino be in operation soon?
"Whereas we intend to make the first complete prototype the coming months, the Dutch Royal Tropical Institute already gave us the possibility to test for Malaria with our machine. Once it works, we want to travel to locations where Malaria is present to really use it."

The DIY community is spread across the entire world. How do you reach this group?
"Of course many networks exist online, but I also try to reach the community with an initiative like the 'Global Official Open Do It Yourself Bio Competition' (GOODIY Bio). With this competition I want to challenge communities from all over the world to come up with, develop and present complete projects. In this way I hope to promote the exchange of experience and best practices. Participants can send in concepts in the categories hardware, software or wetware. The contest will be launched during the PICNIC Festival in Amsterdam in September 2012. More information can be found on www.goodiybio.org."

About Pieter van Boheemen
Pieter van Boheemen is project manager and consultant at Science Alliance, where he works on forming consortia. He wants to build bridges between academics and entrepreneurs. Pieter studied Life Science & Technology at Delft University of Technology and Leiden University, and he has a lasting fascination for biotechnology (life sciences), electronics and ICT.

DIY Icosahedron DNA dice

BY ADAM ZARETSKY

Cut out the paper model along the outer edges, score and fold all inner lines inward. Fold the flaps and glue them onto each other. Ready.

"Random mutation is the other half of natural selection, the irrational half" (Adam Zaretsky). Why did our hands develop with five fingers and not with six, or three? Why are our eyes brown or blue or green of grey, and never purple or white? Adam Zaretsky's dice helps understanding the random development of species. Throw the dice several times to get a random sequence of amino acids, forming a DNA string. Find where this DNA string exists in nature, using BLAST software (blast.ncbi.nlm.nih.gov). There is a large likelihood that your random string is part of a living organism! Why did species develop the way they did? By chance...