12 Conclusion: Between Politics and Promise

> "In the same way, the real significance of DIY biotechnologies might lie not in any particular technological achievement but in the provocative questions they raise. They may never cure cancer. Yet their idealism and critique of the scientific establishment could make a lasting impact. In reality, American DIY movements have rarely been about dropping out of society but about clever reimaginings of social norms. Biopunks do not build their lab tools to maintain some kind of purist separation from the existing system. They want to force the conversation about how that system works and who it serves." *(Wohlsen 120)*

> "The ultimate DIY project becomes the body itself." *(Chrysanthou 471)*

For Wohlsen one of the fundamental aspirations of DIY biotechnologies seems to lie in their critical nature: They raise questions, provoke thought, start conversations, open science. Through its tales of biohacking in practice, Wohlsen's book is part of this quest. Only when DIY biology is talked about, inserted into public discussion, represented and debated can it live up to its potential. This potential lies not in technological innovations but in culture and society – in its political weight. It attempts to shift social relations and scales of power, to create new ideologies of participation and epistemologies based on fun and experimentation. Most of the techniques of DIY biology and medicine are "boundary-blurring practices" (Ratto and Boler 18) that bridge fields considered as oppositional and bring them into conversation: collective/individualistic, nature/culture, private/public, open/closed or proprietary, top-down/bottom-up, inclusion/exclusion, lay/expert. As Ratto and Boler argue: "DIY practices ideally create [a] 'maneuvering' space," in which we can "rethink binary distinctions" (18). This "maneuvering space"

opens up possibilities of intervention and transformation into existing structures of knowledge production, outdated systems and the status quo; differential distributions of power and resources; the minute particles of life and the flesh and blood of the human body. In DIY biology and medicine individuals become agentic subjects *and* objects of intervention at the same time. DIY biology, following Meyer's train of thought, is both a continuation of the "involvement of amateurs and citizens" in science and a rupture because now people do not only want to observe and describe but experiment with and (re)engineer the biological world ("Hacking" n.p.). This 'tinkering' with the biological world extends towards the human body itself – in many of the technologies the (material) body indeed becomes the "ultimate DIY project" (Chrysanthou 471).

Four Strategies of DIY

On the basis of my analysis and discussion, I want to delineate four, often interwoven, strategies of how DIY is employed and represented in biology and culture. The most cited and probably most influential strategy is that of a *symbolic force* or *creative intervention*. However, many commercial forms, and those with a higher prevalence in society, in fact are far from being creative interventions. Instead, they can be regarded as *coping mechanisms* in a world of uncertainty and vulnerability, a *requirement* in an emergent regime of biomaking or a *marketing strategy* employed by start-ups and medical companies. These strategies exist alongside each other, can vary according to the practitioner and context in which they are used.

By many scholars, DIY biology is seen as part of a whole array of interventions with similar ideologies: It is not an "isolated phenomenon" but part of a conglomeration of DIY initiatives in different domains (Keulartz and van den Belt 16). According to Delfanti, "transparency, sharing, distributed creativity, peer production, and distrust for institutions and bureaucracies are becoming more and more widespread" today, examples of which can be found in the hacker network *Anonymous*, the leaking platform *WikiLeaks*, the maker movement, or the Pirate Parties in Northern European countries (*Biohackers* 138).[1] DIY approaches to biology and medical technologies can be part of this shifting value system, especially in their guise of *creative intervention*. This strategy is mainly visible in educational tools, open-source programs and technologies, inclusive projects and patient advocacy, but also in more extreme bodyhacks and niche phenomena, such as implantable (medical) devices or DIY medications, which often have a high potential for polarization. Here, DIY techniques work as demonstrations: they demonstrate the feasibility of (new) technologies, that different forms of arriving at knowledge are possible, that systems of power can be restructured, that things *can be done otherwise*, that they can be done better, cheaper, more accessible. As "vectors 'from below'" these demonstrations "introduce doubt and controversy" (Rose and Novas 446-47), working against the system, dependencies, capitalism, subordination. According to Delfanti, DIY biology's success is based on this "symbolic power" and quality: "DIYbio,

1 In the US, especially *Anonymous* and *WikiLeaks* have created a stir, most prominently *WikiLeaks* through its highly controversial involvement in the 2016 Presidential Election.

making biology hackable in all these different ways, is producing the picture of a different way of conducting research in the life sciences: more open, horizontal, within a very mixed constellation of different actors such as start-ups, universities, individuals and community spaces, with a prominence of small and open companies instead of the slow giants of Big Bio." (Delfanti, *Biohackers* 126) These creative interventions could, in the end, also create a new culture of science. For Delfanti, scientific cultures can and should be updated with new cultural elements and norms: The hacking of biology, thus, for him is also an "innovative recombination of cultural elements" and science (*Biohackers* 16, 130). This recombination of different elements and ideologies has the potential to create "a novel, alternative paradigm of knowledge production outside of the academia and industry walls" (Keulartz and van den Belt 2). DIY biology and medicine here takes on its guise as a social movement, it is a type of "critical making" (Richterich). But beyond this symbolic interference in systems and structures, it is also symbolic on a more personal scale – opening new ways of engaging with the body, getting to know one's biology, optimizing it where desired.

As symbolic force and (political) demonstration, DIY biology and medicine can *generate conversations*. Especially those more controversial hacks attract attention: They can raise questions, overstate and exaggerate to inspire wider debates about technological possibilities and how they can or should be used. DIY, thus, opens the possibility for wider cultural and political dialogue about biotechnologies and biology (Stevens 355). In her discussion of DIY democracy, Caroline C. Lee argues that the process of public engagement and citizen participation, of dialogue and deliberation, is also a means of managing and slowing down the "breakneck pace" of contemporary life and social change (cf. 229). Similarly, taking part in science and technology, doing it oneself or together, can be a means to connect with and understand what is happening, to alleviate the uncertainty, fear, uneasiness that comes with change. To 'do-it-yourself' can mean to put on the brakes and individually, and collectively, evaluate what is done, how and why – and to then make the conversations that need to be held about future and current applications of biological technologies more inclusive. Meyer quotes one of the founders of the biolab *La Paillasseis* in Paris, who claims that one political aim of DIY biology is to be a "counter-power" to participate in societal choices ("Build" n.p.).[2] DIY biology, in this case, is configured as a "public resource" (Gruber 3). The cultural discussions about the norms and ethics that guide our relationship to technology are shaped by accepted and new values, accepted and new approaches as well the possible contradictions between them. This transformative potential points to the connection between technology and culture: It is not a technological but a cultural revolution because it shapes inherently social, political, cultural questions and core values such as access, property, power, knowledge and creativity (Ledford 650; Delfanti, *Biohackers* 12). Their symbolic power is also what remains when DIY biology fails to deliver on its promises, when DIY hacks are not used or prove unfeasible. Krupar and Ehlers argue that biocultural studies, like the one presented here, must also work towards pointing out "alternative biofutures," in which neoliberal modes of governance are resisted (14): As creative interventions,

2 This term indicates a similar „anti-establishment" ideology and calls to inclusion and participation as the 1960s counter-cultural movement.

practices of DIY biology point to such alternative futures and alternative ways of being and perceiving the world.

The cultural transformations, on the other hand, might also turn out to be in stark contrast to this ideal: a new "bio-making regime" in which biohacking the self becomes a "moral imperative" and tool for neoliberal governance (Jen). As much as they can be liberating, also "alternative body knowledges" (Krupar and Ehlers 3-4) such as DIY technologies can become a constraint, subjecting people to an ideology of active participation, self-education and self-transformation. Especially more mundane DIY biology and medicine techniques often are an expected form of self-care, a *requirement*. In many cases those are more commercial and widely known forms such as genetic testing, self-tracking, exercise, nutritional 'hacks' and the like, but also self-education, the ideology of DIY insinuates, is needed to assert one's status as a biological citizen. To be a prudent citizen means to hack and (re-)make the body, to use the tools now available, to engage in the discussion around (new) biotechnologies – to be involved, engaged, curious and flexible. In our neoliberal market economy, people have to invest into their body in order to reap the benefits. These investments can take multiple forms from membership in fitness studios, to costs for surgeries, to expenses for tests, supplements and equipment, to time and effort.

This body-in-progress borders on coercion: Investment and enhancement are not only an option but a responsibility if one wants to ensure future competitiveness in the global marketplace. We need to be willing to "replace our identities with market-driven, slightly altered, and improved ideals of ourselves" (Wegenstein, *Cosmetic Gaze* 125). If we do not want to become 'obsolete,' we need to enhance our self, our performance and our body. This strategy is also related to one of the starting places of biohacking's cultural ubiquity: Silicon Valley and its culture of competitiveness, high achievement and high performance. Under the guise of authority and agency, foundational American values such as self-reliance, initiative, self-directedness are taken to new extremes, subjecting people under a new cultural politics of life. While, as creative interventions, the same techniques are understood as tools of empowerment, in this strategy they become *tools of governance*, not of top-down approaches by states or regulatory bodies but divided and distributed forms of peer and self-governance. In a new form of "sousveillance" (Lupton, *Quantified Self* 61) people monitor the self and others. The result of this strategy of DIY, as we have seen in the previous discussion, is a neglect of social and structural factors in favor of personalized responsibility as well as new types of discrimination, devaluation and unjust distributions of technological resources.

While DIY as a requirement implies a top-down or peer-controlled authority, individually those same technologies can be used to *cope with* the realities and vulnerabilities of contemporary life. For example, for some practitioners, DIY biology and medicine meets a desire for community, interaction, and social relationships in a highly individualized society: "The biohacking community also offers just that: community. It gives people a chance to explore unconventional ideas in a non-hierarchical setting, and to refashion the feeling of being outside the norm into a cool identity." (Samuel, "How Biohackers") It can become a way to assert a new 'cool' identity as biohacker, a member of a community of like-minded individuals. For others, DIY biology and medicine – and the information extracted through its use – can be used to establish their biological

individuality. The biological knowledge gained for example through genetic testing can provide individuals with something tangible, though invisible through which they can assert their identity: "This is me; I am unique." Asserting the self through its biology can be empowering, especially in situations where people previously felt out of control, overheard, or neglected. At the same time, this individual identity exemplifies a radical situatedness in a community of biological beings, made-up from code and matter, same but different.

Additionally, more extreme forms such as grinding, but also commercial forms like tracking, DTC testing, pills and supplements – all often aimed at self-knowledge and self-enhancement – can be a strategy to come to terms with human frailty and mortality more generally. These technologies are used to counter biological vulnerability, social precarity, or diffuse feelings of helplessness, to fulfill a deep-seated desire for control and optimization. As Sigal Samuel writes, many people participate in biohacking out of a "desire to feel better – and to see just how far we can push the human body." However, when used as a *coping mechanism*, there really is no (natural) end point to biohacking. Or as Sigal Samuel explains to his readers, the goals of biohacking tend to "escalate:" "Once you've determined (or think you've determined) that there are concrete 'hacks' you can use by yourself right now to go from sick to healthy, or healthy to enhanced, you start to think: Well, why stop there? Why not shoot for peak performance? Why not try to live forever? What starts as a simple wish to be free from pain can snowball into self-improvement on steroids" (Samuel, "How Biohackers"). Here, we once more encounter the problem of the free-floating and moving target of perfection: Where do we stop our crusade to know more, control more, enhance more, when we always find new targets for interventions? As technologies advance, more areas of life will become even more uncertain – providing even more targets for the promise of extension and enhancement.

Lastly, in its assemblage with consumer culture 'biohacking' has become a marketing buzzword and pop-cultural obsession, used to sell unregulated products or "repackage old products, such as coffee with butter" (Hamblin). Pharmaceutical and medical companies, but also small start-ups, use this cultural hype for economic exploitation: 'biohacking' as a label is used to sell lifestyle products – supplements, nootropics, tests, the services of the new "experts of the soma" (Rose). Old techniques and technologies are reframed as hacks to monetize a trend. As a *marketing strategy* DIY biology and medicine is not just fully integrated into consumer culture and the dictate of the market, but it actively takes part in the formation of new "economies of vitality" (Rose) around the self-directed intervention into biological systems and the human body. But if hacking today is such a fashionable term and practice, where does that leave its 'real' potential and transformative ideas? Does this reframing subvert hackings potential to undermine dependencies and abolish exclusions? How can we even distinguish between 'real' hacking and its 'in vogue' cousins? As the discussion in Chapter 11 has shown, consumer culture also offers great potential for DIY biology and its promise of access, if done right.

Promissory Narrative

What these different strategies share is that at their core they combine a mythology of American individualism with biotechnologies' promissory narrative and fantasies of self-knowledge, self-control, and self-enhancement. Fantasy, promise, imagination – these are also central factors in the cultural representation of DIY biology and medicine and might as such also impede on its real-life practices. DIY biology and medicine is deeply embedded in the "promissory discourse" surrounding biotech and biomedicine more generally, a hope for scientific solutions and the promise of science's absolute power. For Jen, "promissory narratives…generate future-oriented abstractions in the form of expectations, hopes, and promises." Discourses around bio-making, she argues, generate this type of positive anticipation by promising a future that is "more democratic than the present" (128). Similarly, Aguiton and Tocchetti describe DIY biology as a "promissory socio-technical vision" (829) of a democratized science with access for all. DIY biology and medicine, we can see here, is also a (political) *promise*: a promise of access, of democratization, of empowerment, of control, of equality, of opportunities, of community, of enhancement.

This promissory nature, of course, means that DIY biology and medicine as much as it is concerned with changing the here and now, is always also future-directed, guided by optimism – or pessimism – about the future. It is about tomorrow and the promises of tomorrow. Delgado argues that this promissory nature is not necessarily oriented towards the "realization of grand narratives and promises" of technological futures, but that it more often makes "mundane futures in every-day practices," "makes novelty by hacking trivial things" (71). Some scholars criticize that the DIY biology movement has been "over-hyped" (Ledford 650), that especially the media attention has "overstated and mythologized" what is going on in the movement, which is far from ground-breaking research and innovation but rather "political, artistic and educational experimentation" (Delfanti, *Biohackers* 115). It is not necessarily a future of sweeping transformation and upheaval – the redefinition of humanity, the realization of transhumanist dreams of longevity, immortality and extension – but a more grounded vision. DIY biology's promise is a *political claim*, the "promise of a future in which citizens are more autonomous as they are entitled to do biology" (Delgado 71). The practices of biohacking, Delfanti writes, are not just "hands-on approaches to technology" but "a means of creating new politics," "geared towards the development of concepts that lie at the very core of our societies, such as openness, property, freedom and autonomy" (*Biohackers*, 139). DIY biology can shine a light on alternative practices, alternative solutions, alternative ideologies. It creates a "public shaped by the promises and imaginaries brought about by narratives of democratization" (Meyer, "Fabric" 873).

In its essence, DIY promises a certain type of utopia. It is not just the utopia of a perfect body – Chrysanthou's "somatopia" with its material effects – but also a socio-political utopia. "Since Thomas More and the utopian genre's inception, utopia has been both the description of an impossible place and the impossible social relations within that place," writes Sean Grattan (4). But Grattan himself takes utopian discourse and narratives to mean more than these traditional definitions: For him, utopia is about hope for the future – "striving for another world, a better life, or at least the very pos-

sibility of a better life" (20) – as much as a struggle between the present and its utopian potential (3). Imagining and articulating the possibility of a different world, of different social relations, of hope for the future, if we follow Grattan's train of thought, already attempts to bring that world into being. Similarly, both the ideology of DIY and its (small-scale) implementations attempt to fulfill DIY's utopian potential. It is here that the power of its promises might unfold. Affective structures, promises, desires, or hope for the future shape how we engage with biotechnologies and our own biological materiality, collectively and individually. However, as is the case with all these 'non-places' also DIY biology and medicine might fall short of its utopian promise, at least partially. Coercions and requirements to take part, questions of data privacy and security, potentials for discrimination and abuse of technologies already point into that direction.

Now and Tomorrow

As this book demonstrated, multiple pathways in our contemporary cultural moment have intersected and combined to form a new outlook on life and how it should be lived, new obligations and responsibilities, new forms of community and modes of individuation, new means of participation and agency – in short, a new "politics of hacking life" (Meyer, "Hacking" n.p.). Of course, since the inception of the first DIY biology groups and the rise in media and academic attention the configurations that led to DIY's growth have continued to evolve. It is thus worthwhile to, in the end, take a last look at the current situation. It seems like today more mundane hacks receive the most media attention, 'biohacking' and 'DIY biology' have become more common, and are covered also by mainstream magazines and media, especially when they aim at self-enhancement. Nonetheless, not surprisingly some of the more extreme forms of biohacking have gotten (critical) media attention as well, such as Josiah Zayner's public DIY CRISPR hack or his fecal transplants. Among those more extreme forms we could count 'young blood transfusion,' which is becoming popular in Silicon Valley, at least if we believe the media attention this technique hast gotten. On the practical side, more extreme practices, such as grinding, implants or magnets, have not (yet?) seen the rise that was predicted also by the widespread media coverage they received in the early 2010s. For now, the future seems to lie in wearable technologies and, more importantly, the consumer market. As CRISPR technology – the new buzzword in the DIY scene – becomes easier and more consumer-friendly, this focus might also morph from the technological to the molecular.

Apart from the future configurations of DIY biology and medicine, this book of course could only touch upon some larger concerns in passing. Journalist Adi Robertson, lamenting that she "hacked [her] body for a future that never came," details how some biohackers see more potential for the future of biohacking in European countries. One of her sources, Amal Graafstra, founder of *Dangerous Things*, has witnessed a decline in sales in the US after the election of President Donald Trump in 2016.[3] While

3 Graafstra muses that President Trump's election resulted in a decline in optimism and excitement for the future in his target group. They now had more pressing issues to worry about than the optimization and enhancement of their bodies, cf. Robertson.

they have recovered slightly, Graafstra is now "pessimistic about the future of biohacking in the US:" "'We're the old man on the porch, and the young kids across the pond are doing the cool stuff now,' says Graafstra" (Robertson). Despite their origin in the US, Graafstra proposes that more exciting advancements and institutionalized uses of biohacking technologies will come from Scandinavian and Western European countries. A more detailed global perspective on DIY biology, thus, is worth more consideration: In different countries and regions of the world different types of biohacking are popular, often based on cultural differences and acute and actual needs (cf. Kera; Seyfried et al.). Juxtaposing the differences between DIY practices in different regions of the world, their different values, norms, connections with industry and legislation, their practitioners and their boundaries, and last but not least its effect on bodies and embodiment would deepen our understanding of the global currents, interconnections and possible downsides. We need to understand DIY biology as a transnational phenomenon that participates in trades and trade-offs around the globe, that spans more than one territory, region or nation state, that is interconnected and intersected. Some of these intersections should be examined very carefully because they risk turning from modes of participation and equality into modes of colonization and imperialism, for example when it comes to differential distributions of resources, global flows of data and use of human research subjects.[4] At the same time, we need to continuously question our own understanding of research and knowledge and follow the lead of local, indigenous communities and makers, their thought systems and epistemologies.

In addition, the legal frame of DIY biology and medicine poses new questions about its regulation and legislation, patents and patent regulation, restrictions on access and knowledge: How do and should we regulate (dangerous) knowledge in the age of information? How do we keep individuals and communities safe without impinging on values such as freedom of speech and autonomy? How do we balance data sharing or data philanthropy with data security and data privacy (cf. Ajana)? Similar questions arise when we look at its moral and ethical implications: Should we allow (unending and unregulated) human enhancement? What is the worth of human life? How do we avoid slippery slopes towards new eugenics? How do we ensure accountability, lower the danger of misinformation and prevent the mis-use of technologies? Of course, such overarching questions cannot be answered in the limited scope of this book. Likewise, also the feasibility and practical application of some techniques and technologies are not part of this discussion – and not part of my area of competence. It is, however, certainly worth its time to investigate whether some of these technologies are applicable on a broader scale or feasible at all.

Nevertheless, we need to acknowledge that DIY biology and medicine is still in the process of formation, or rather, it will always remain in the process of formation: Its boundaries are still liquid – and open to debate – its configurations shifting. Morgan

4 For a critical examination of global data flows, cf. Keune. The clinical studies and problematic global distribution of the Covid-19 vaccines are just the latest example of differential distributions of resources and ethical dilemmas in human subject research, cf. Liu et al.; Pfeiffer and Washington. For a historical look on racial injustices in health research and the American health care system, see also Washington.

Meyer contends that it is not yet an established "amateur science" but a "promised amateur science, a citizen science 'in the making'" (*Domesticating* 8). Its reliance on technologies and technological change means that it will probably remain "in the making." As new technologies emerge, as old technologies are re-shuffled or become more affordable, as new knowledge is produced and old knowledge solidified, the techniques used to peer into the human body, to hack biological materials, to tinker with technologies will shift as well. Some of the tools and techniques in my discussion will become obsolete, others will become routinized and expected. And because they rely so much on age-old human desires (to be involved, to become better, to transcend what we currently are) and curiosity (to know more, to know the self) we can be certain that new ones *will* emerge. Most of them, I would argue, will fall into either one of the categories I delineated above – or multiple ones at the same time. And since these techniques and practices stem from similar values and basic prerequisites, the questions, issues and concerns discussed here will most likely still be relevant for new, constantly evolving technologies as well.