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Ethical and epistemological problems of hybridizing living beings: Biofacts and body shopping

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Summary: This essay deals with epistemological, anthropological and ethical problems in relation to the applied Life Sciences. By introducing the neologism "biofact" a hermeneutic concept is developed, which allows one to enquire into the differences between "nature" and "technology" in the domain of the living. "Life" is examined in an intermediary perspective between subject and object and is outlined by reflecting on the term "growth". The borders between the natural and the artificial are becoming increasingly vague, including those relating to the body's inside and outside, not least through recent biotechnological advances, where "life" is regarded as a quality applying to epistemic objects within scientific categories. Here, the fragile identity limits of the human individual in the context of the anthropological concept of hybridity are discussed. Last but not least, some of the wide-reaching ethical consequences of the extraction and fusing of biological parts of the human being, i.e. making biofacts, are detailed.

Zusammenfassung: Der Beitrag widmet sich wissenschaftstheoretischen, anthropologischen und ethischen Problemen im Anwendungskontext aktueller Biotechnologien. Mit dem Neologismus „Biofakt" wird ein hermeneutisches Konzept vorgestellt, das nach dem Unterschied von "Natur" und "Technik" im Bereich des Lebendigen zu fragen erlaubt. "Leben" wird dabei vermittelt zwischen Subjekt- und Objektperspektive untersucht und im Verhältnis zu "Wachstum" als Reflexionsbegriff bestimmt. Nicht nur durch die rezenten Biotechniken, in denen "Leben" ein Begriff für epistemische Objekte innerhalb natur- und technikwissenschaftlicher Kategorien ist, werden die Grenzen zwischen "Natur" und "Technik" zunehmend phänomenal diffus. Auch im Hinblick auf das anthropologische Konzept der Hybridität des Menschen zeigen sich die fragilen Identitätsbedingungen des menschlichen Individuums. Die Möglichkeit, biologische Teile des Menschen isolieren und fusionieren zu können, d.h. Biofakte zu "machen", hat nicht zuletzt weitreichende ethische Konsequenzen.

1. Introduction[1]

Let me start with three questions:

1. Is there still a difference between the concept of nature and the concept of technology (in the light of new biotechnological developments)?
2. Does growth play a significant role in making up this difference?
3. Do we still need this difference?

In this article, the answer on all these questions will be a "Yes". I will argue that the difference between nature and technology does indeed still hold today, but that in recent

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decades the distinctions have become much more hidden than before, first of all by the design of living objects in laboratories, and, second, by their release into the public sphere. A third reason is the application of plant related techniques (e.g., transplanting and cloning), mostly derived from agricultural practices, into the biomedical sphere of the human body. The different meanings of "body" involved in this argumentation will emerge in due course.

A laboratory in the Life Sciences can be described as a limited sphere of changing natural entities to living *prototypes* by scientific knowledge and technical expertise. These prototypes are then released as products into the public sphere, in the *real* world of experience and living practice (i.e. the life world), afterwards. In a way, also the human body can be such a prototype. Consequently, ethical debates on the allowance of this prototyping are put on the agenda (see part 4). Because of the blurred border between society and laboratory and the ubiquity of prototypes, Wolfgang Krohn and Johannes Weyer generally call modern societies "laboratories" (Krohn, Weyer 1990). The type of experiments which have started in a laboratory and then are extended to the life world, are named "real-experiments" (German: "Realexperimente"; see Krohn 2007). Real-experiments pervade society as a whole and change its cultural practices by a unique testing culture, starting with intelligence tests on intellectual and other mental properties (see Illouz 2008; Karafyllis, Ulshöfer 2008) since the beginning of the 20th century, and ending up with pharmaceutical and paternity tests on genetic properties at the turn to the 21st century. Testing is relevant for designing, or, in psychomedical terms, diagnosis is relevant for therapy. The potentials of the human soul have been rewritten in various respects, a fact which Ian Hacking relates to *anatomo*-politics, *bio*-politics, and – arguing beyond Michel Foucault (1980) – *memoro*-politics (Hacking 1995, pp. 214ff). Not all of these scientific preconfigurations of human knowledge and nature's potentials are still visible when they arise within overall society, as can be exemplified in the case of doping or transgenic organisms, the latter related to both *anatomo*- and *bio*-politics. In these two cases biomedicine has pervaded and transformed the body without showing it on the phenomenal level of every-day experience, and, in the case of transgenic organisms related to breeding contexts, the term "body" encompasses the population. As a result, the designed organisms can "naturally" pass their new properties into succeeding generations. Due to this epistemic 'veil of ignorance' in society, a third status between naturalness and artificialness, which I call *biofacticity*, is made plausible. It is also related to *memoro*-politics which helped to establish a Western attitude that is characteristic for the 20th century, and beyond: people are less concerned with forgetting information than with hiding it. However, it is not only the impossibility to perceive the products as such which causes – mainly anthropologically relevant – problems, expressed as a public resistance to related biotechnologies and the resulting products (e.g., transgenic food in Europe), but also their ubiquity on global markets. Biofacts are pervasive in a multifold sense.

Biofacticity is related to the overall idea of hybridity, but as a term it is reserved to the epistemological level, i.e. the different ways of perceiving and knowing something – which is scientifically reconfigurated – still *as this* "something" (e.g., a mouse). The idea of hybridity is quite prominent both in Science and Technology Studies (STS) and Post-Colonial Studies. For the latter, hybridity means "the creation of new transcultural forms within the contact zone produced by colonisation" (Ashcroft, Griffiths, Tiffin 2003, p. 118). What the idea of hybrids in science and technology research shares with the view mentioned, is its focus on transformations of identity in the wake of fragile borders. For instance, economic and political borders (markets and nations), borders of the body (inside/ outside), and of culture (e.g., health concepts) are touched. For philosophical purposes in a narrow sense, the term hybridity belongs to anthropological thinking. In a broader sense, it

belongs to ethics as the anthropological *Menschenbild* is established in accordance to normative assumptions concerning what the idealtypic human *should* be.

Obviously, in hybrids different kinds of mixtures are supposed to build new units, while still allow recognizing the former boundaries. Other than hybrid motors, which can still be deconstructed into its single components, living 'hybrids' (which I named 'biofacts') cannot. The process of growth and, at the same time, the act of a technician who initiates a certain growth type, turn them into a new unit. The result is a third entity made up out of the two spheres of nature and technology. This phenomenon is well-known at least since Aristotle's description of (gr.) *symphysis* after the inoculation of plants, i.e. a technology to optimize their growth in specific ways. Aristotle distinguishes the *symphysis* from *synthesis*, the latter meaning an aggregation of parts or particles. He realized that fused living objects are no technical aggregates but something else. But to which kind of topological sphere do they belong: nature or technology? Aristotle leaves this question open because in antiquity both spheres were embedded into the overall concept of the (gr.) *physis*.

Aristotle said in *De anima* that whatever grows is natural and hence 'life' can be identified with nature, starting with the activity of plant soul (lat. *anima vegetativa*). Somehow in contrast he stated in his *Physica*, whatever is moved externally does *not* grow, but is considered *technē*. This antithesis corresponds to our common sense intuitions: trees, children and hair grow, whereas machines and other tools do not. In addition, self-moving automatons do not convince us that they are natural, even if they have held the illusion of having body-like features for many centuries and inspire technological visions of 'man-machines' and humanoid robots. In the light of recent advances in biological and biomedical technologies, it is not artefacts which are produced, but *biofacts* (Karafyllis 2003, 2006b). As the term "hybridity" is reserved for anthropological purposes (see part 4), I suggest the term "biofact" exclusively for the epistemological level. With the neologism 'biofact', a hermeneutic concept is developed which allows asking for the differences between 'nature' and 'technology' in the area of the living. 'Life' thus is examined in an intermediary perspective between subject and object, and is outlined by reflecting on the term 'growth'.

2. Growth and Growth Categories

Growth is the necessary presupposition for both: starting biotechnical design activities and bringing them to appearance. It functions as antecedens and mode of continuity of a self, exceeding the status of a mere material conditional. What makes 'growth' an interesting term from a philosopher's point of view is that the categories of cause and reason seem to melt into one. This means, it affects the relation of 'nature' and 'culture'. In Aristotle's works, growth is a special kind of an overall movement of the *physis* and thus reserved for the topos of nature. It includes coming into being (gr. *genesis*) and fading away (gr. *phthisis*) – and thus is strongly related to the living world. Aristotle interprets growth both quantitative (increase/ decrease) and qualitative (coming into being/ fading away), which can be understood as an objective versus a subjective view on 'life' in a modern reading. On a meta-level, both perspectives are connected by the category of change (gr. *alloiosis*) and by the ontological concept of substance (gr. *ousia*), which always holds its own potentials from the very beginning (gr. *arché*) of being.

Since early modern times, the concept of substance was reduced to (lat.) *materia*, which

corresponds with a form open for designers to some extent. Biotechnological progress could and can make use of specific quantitative and qualitative changes of organismic growth patterns. But this design still is embedded in organism-specific growth types and limited by the birth and death of living entities. Furthermore, growth in modern biology is dealt within evolutionary thinking.

When we look at the biological understanding of growth, we find different terms, e.g. increase (of cell volume and cell number), morphogenesis, differentiation, complexity. They are inspired by theories of various disciplines like physics and engineering, and biological sub-disciplines like genetics, physiology and embryology. Until recently, the humanities have employed concepts of 'nature' and 'life' that ignore the problematic notion of growth in biology, medicine and psychology, and the biological sciences continue to operate with a concept of growth which is neither unified nor comprehensive. Today it is common in Life Sciences (and socioeconomics) to differentiate between 'growth' and 'development', resembling a distinction between quantitative and qualitative characteristics of life, which in reality never can be found.

Due to the recent success story of genetics, meaning a research program of analyzing and designing mainly qualitative characteristics of organisms while they develop, 'growth' is understood in a reduced manner and is by now a *dead metaphor* in Life Sciences. The source domain of the metaphor, plant growth including its related phenomena, has been forgotten. Therefore, reduction and abstraction are not felt as problem within the scientific community. This has implications on the epistemological level of bioscience: the use of related terms like 'increase' or 'proliferation', by which growth is explained (as *explanans*), implies a common sense notion of what growth actually *is*; but that at the same time in epistemic contexts this notion is reduced to model and provoke processes, which always already show growth as presupposition of a continuity of being (as *explanandum*). Due to the fact that – also outside the laboratory - we are somehow very sure what growth is, it is not called into question for connecting 'the natural' and 'the living' in modern times. This eases the export of biofacts into the public sphere. Behind the circular epistemic argumentation mentioned above, we find the ontological problem of how to decide, if something is actually growing and, hence, if something is actually living. Synthetic biology and Artificial Life-research nourishes the doubts, if the connection of growth and life is still a necessary one (Helmreich 2000). Maybe, one can assume, it could be replaced by aggregation of particles, which end up in resembling an organism. The "new" idea of systems biology is highly inspired by this bottom-up approach. However, 'living' means a state of being which means more than just to be alive. Moreover, "living" cannot be epitomized. 'To live' implies a biography, leading to a referable starting point and its spatial and temporal determination. Already Aristotle had an ontological problem with the permanent growing, but non-perceiving plants. In *De anima* he assumed plants to be 'living things' (gr. *zonta*), and not (gr.) *zoa*, i.e. real living entities like animals and humans. Nevertheless, all living things had an ontological starting point of being, the (gr.) *arché*, and moreover were united by the idea of the soul (gr. *psyché*).

Experimental science can both name and stimulate biological growth so that only the abstract starting point of genesis remains as 'nature'. Whatever grows can equally well be understood as artificial, depending on the feature taken as characteristic of growth, e.g. increase or reproduction, and depending on technical terms, e.g. 'functions' and 'tools', which are used to describe and model cells, tissues and organs. Growing entities necessarily lack *concreteness*, which makes technological approaches to design them challenging. To postulate that something is growing can be understood in different ways. One is to use 'growing' as *alienans*, i.e. as an adjective that appears to be qualifying a

subsequent description, but functions to leave open the question of whether the description applies, like e.g. 'a near victory'. The potential of a specific entity is emphasized as well as the possibility of a certain outcome, e.g. when we say that lizards can regenerate their tails by the means of growing cells. Observing that lizards have the potential of totipotent growth in some of their tissues, one can assume that they *will* actualize it, once their tail is cut. Another is to use 'growing' as substitute for 'living', referring to the continuity of process that implies the overall estimation of what living entities, and not only lizards, in general do. In the second context, background theories of evolutionary thinking become important, determining the overall growth type in which species and organisms are tokens. The instance of this type-token-relation is the reproduction of organisms and biological species, guaranteeing both identity and alterity of the process.

To sum up: the term 'growth' is used in Life Sciences in a threefold sense, building distinct categories with different theoretical backgrounds, but referring to cultural history:

- Reproduction
- Regeneration
- Permanent and persistent Growth (Process/ Progression)

All three types can best be demonstrated by plants, which always have been a cultural symbol for growth. They lack a limited body with skeleton and central organizing units like heart and brain, and, after they have died, do not leave a (lat.) *corpus*, but decay. Trees are somehow an exception and were always handled separate in natural philosophy, as were carnivorous plants. Because trees leave a corpus, because they are able to overcome gravitation by growth and because their life time exceeds the average human life span, Aristotle regarded them as the highest forms of the vegetative soul. 'Reproduction' was and still is also called 'Fortpflanzung' in the German language, meaning a continuous repetition of something *planting* itself. Neither 'offspring' nor 'proliferation' emphasizes this plant characteristic of growth, which also is used on animal and man: planting a self without *being* one.

'Regeneration' is an additional characteristic of plants. The organisms which showed regeneration after being cut, like the polyp *Hydra* spec., were regarded as plants until the late 18th century. If we say, that something regenerates, we apply a *teleologic* understanding of growth, i.e. a growth resulting in a specific end. On the contrary, 'reproduction' in a modern sense just refers to copies of an organic self, which remains productive in order to produce more. Here the most problematic term behind is 'identity'. Finally, permanent and persistent growth is the ideal type of unlimited growth, which some trees (oak, sequoia) show for many hundred, sometimes a few thousands of years. As evolutionary 'tree of life', famous especially by the publications of Ernst Haeckel (Bredekamp 2005), permanent and persistent growth which keeps being rooted in a beginning, means a genealogic view of life as a whole. It is a process which will be altered, but never is supposed to cease.

In the laboratories of the Life Sciences, these three categories of growth intermingle when 'life' is designed and ends up in biofacts – and so do their metaphorical backgrounds.

3. Biofacts

The term 'biofact', a neologism comprised of (gr.) '*bios'* and 'artifact', refers to a being

that is both natural and artificial. It is brought into existence by purposive human action, but exists by processes of growth. Why do we need a new term? While conventional ways of describing the artificial element in nature sharply distinguish between the natural and the artificial, the term *biofact* can account for the influence of technology on previously existing natural forms of growth (resembled in certain species, and their bodies), and allows for reflection on the existing borders between nature and technology, when it comes to designing practices of life. Conventional terminologies of designed living entities originate in different disciplinary and everyday contexts, ranging from agriculturally based breeding practices to the science fiction film genre: bastard, genetically manipulated organism (GMO), chimera, clone, replicate, cyborg etc. This complicates their employment as terms in a scientific context. By contrast, 'biofact' is a neutral term that can contain a wide spectrum within the two poles: natural living entities and technical artefacts. It shows that 'life' is not a secure candidate within the category of nature any more and that not only construction, but also growth is a medium for design. Human action and natural growth interfere in the act of designing, producing cloned individuals as well as biomaterials and transgenic organisms. The interesting point is that for the design process of the living objects the activity duration is *determined* by growth, not by human action. Due to the reproduction of cells, life of former living entities is always a precursor of the design process to be established.

Spoken philosophically, biofacts are living beings since they grow, but their development is no longer self-determined. That means whereas the presupposition of growth always was only comprehensible with reference to ontology and metaphysics, the presupposition of development now seems to be analyzable in the perspective of "systems biology", e.g. in genetics allied with neuro-, cogno-, and computer sciences. Both in 'the brain' and 'the gene' we presently find hyper-coded terms, because the related disciplines fuse causes and reasons. Recollecting my previous remark on the term 'regeneration' and its inherent teleology, the new subdiscipline of regenerative medicine, aiming at the re-growth of dysfunctional organs, or organs which were not established at birth time or in early childhood, will be faced with nature's remaining autonomy in relation to both a naturally and socially structured 'environment'. The so-called epigenetic phenomena are already a proof of disturbances during the technical act of cloning, arising from the context-levels in which nucleic DNA is embedded. Epigenetic disturbances can arise late in the biography of the cloned one (as was revealed by sheep Dolly's early death), revealing that the technical input from the beginning can co-grow with nature undisturbed for quite a long time.

In biofacts, technology and nature share more than just interfaces, especially since Bio-, Information- and Nanotechnology have been said to melt into the so-called *Converging Technologies*. A differentiation in, e.g., the body and the prosthesis is no longer possible. One could have expected this turn in Science and Technology because of the old idea that protheses are *implanted*. Biofacts can be understood in terms of a plant: they grow and fuse with its incorporating contexts, they assimilate and they can be assimilated. These plant-specific capacities are also used in other biomedical applications, e.g. after the transplantation of organs into the human body. In a way, all living entities start their life with plant-related potentials, allowing them not only to be put, but to be integrated into another "self". The epistemological result is a chimera-like "technonature".

In general, growth can be understood as *medium* and *mean* (in the sense of 'tool'). The same is true for technology (Gamm 2000, Hubig 2004). As medium, growth still is a natural process containing substantial potentiality and supporting the emanation of something living. The form of a living thing in nature is reached *by* and *through* the

medium of growth. In biofacts, growth becomes a mean as the form is still reached through the medium of growth, but not by it. As a mean, growth also has to be manageable enough to reach a certain end. By standardizing cultivation techniques with artificial culture media and matrices, e.g. as soil- or skin-substitutes, and mapped genetic structures of organisms, stored in gene banks as implementable 'information', biosciences have come near to use growth as a tool. Nevertheless growth remains, using Martin Heidegger's distinction, as a tool which has to be both: *ready-at-hand* ("Zuhandensein") as well as *presence-at-hand* ("Vorhandensein"). In different stages of the design process, growth is either ready-at-hand (e.g. in mapping genes of cultivated organisms, i.e. *before* the entity to be designed comes into existence) or presence-at-hand, when the growing entity already exists (within practices of breeding and growth control, e.g. the use of growth hormones). To make a growth type become presence-at-hand, its reduced substantial counterpart (a gene) has to be implemented in a nourishing and stimulating context (e.g. a denucleated egg cell). Only together can something living result.

	Nature	**Technonature**	**Technology**
Entity	Living Being	Biofact	Artefact
Mean	-	Growth	Action
Medium	Growth	Action	Action

Tab. 1: Growth as Medium and Mean.

From an epistemological point of view, there are four epistemic stages (imitation, automation, simulation, and fusion), by which biofacts are made ready-at-hand for design (for details see Karafyllis 2006a). Growth then is at first, in a mechanistic filter of perception, reduced to its material compounds and substituted by movement and functional form, and at second, brought back into reality by plantation techniques (im-, ex- and transplantation). Imitation allows to focus on a certain growth state, in general the one regarded as grown-up, and the plan to design it as (gr.) *mimesis* of nature. In order to do so, the substantial growth potential of the entity has to be fixed into a material state, a 'building mass'. Automation reanimates the thing by movement of the selected automation components that can be interpreted functionally (for the idea of 'the organic', see Köchy 2003). Computer simulation de-materializes the growth process and suggests a complete automation of the specific growth type, which by then has lost its entity. Finally, fusion in the biotech-laboratory works with organisms as media and means, and has to prove if the modelling process can be made *real*. Real is a *living* thing only if it has *actuality*, i.e. if people dealing with it sometimes experience any kind of resistance in their practical work with this living "thing". This definitely is true for working with living objects in the laboratory, where only a small percentage of individuals of a model-organism are normally able to "auto-activate" the implanted genetic structures. Two of the biggest problems remaining for regenerative medicine is, first, to allow the foreign tissue/ organ to pass the border of another self and be accepted by its immunosystem while keeping the immunosystem still in function against invading 'enemies', and, second, to make growth stop at the envisioned point (i.e. to omit various forms of tumors).

4. Ethical Implications

If we take the anthropological perspective into account that humans are *hybrids* (Latour 2006), having both a natural and a technical essence, which makes them designers with an individual "Leib" (a German-derived term in phenomenology for the subjectivity of one's own corporeality), we can ask: In how far does biofacticity, as an epistemological concept, undermine hybridity as an anthropological concept? Thus, we read in Bruno Latour's *Politics of Nature*: "What is a subject, actually? That which resists naturalization. What is an object? That which resists subjectivation" (Latour 2004, p. 47). However, this is rather too easy referring to the challenging findings and practices of the Life Sciences, and specifically its patented products and the associated biocommercial marketplaces. Biofacts do not resist naturalization, and when they are human persons, e.g. cloned individuals, they will also not resist subjectivation (see also Habermas 2001).

The first crucial point for anthropology in relation to biofacticity is: cells to be designed and parts to be fused can belong not only to *either* plants, animals *or* humans, but always methodologically include the application on humans. This affects the category of the human, and its essential difference to other types of living beings. When Ian Hacking described how the triangulation of the modern soul takes place by *anatomo*-, *bio*-, and *memoro*-politics, he refers to bio-politics as follows: "Here we have the politics of the species, of the human race as species to be categorized into its varieties – I use the word as did the horticulturists, seedsmen, and stockbreeders of old." (Hacking 1995, p. 217). In the view of biofacticity, all biotechnologies refer to living things, i.e. objects to be managed, and again: including humans. Even with plants humans share more than 50% of the genetic structure, stressing phylogenetic growth as a continuous evolutionary process of gaining higher complexity. Therefore, how can one break free of this conclusion that the human being can be reduced to a mere living object, moreover partially a plant being?

Martin Heidegger emphasized that, apart from the modern subject-object-dichotomy, the Greek term *arché* implied not only a first beginning of something to be, but also a sphere of its own *dominance* over this one being, respectively being one (Heidegger 1967; Karafyllis 2006a and b, Karafyllis 2007). The hybrid character of the human being as a growing entity and creative person who, at the same time, acts in light of self-determined ends (including to be a technician) allows us to take seriously the fact that human beings exist both within the spheres of nature and technology. One result could be a broad approach towards the idea of life, which allows for an understanding of personal growth in experience without reducing life to biological processes or functions of the genetic code.

However, what about the ethical implications of this own dominance in the light of new biotechnical developments? Presuming that there is not only a plant kingdom, an animal and a human kingdom, but a mixed one, provoked by technical means and ruled by economic interests: What does this imply in a normative sense? Who rules this kingdom? Within the kingdom of biofacts, the human body is, on the one hand, an internal room of generating new "self"-units by means of reproduction, e.g. cells and tissues. On the other hand, the body can still be regarded as a medium of bringing a self into appearance, including all capacities and abilities which "self" means in a phenomenological sense, as put forward by Paul Ricœur. As it seems, we have two auto-topologies conflicting with each other. The idea of the "self" is generally based on a *reflexive* structure, i.e., it is always in need of an "other" (Ricœur 1992). One aim of this chapter is to outline strategies of "othering" in bioscientific discourses, because "to say self is not to say myself" (Ricœur 1992, p. 180). A gap always exists between *selfhood* and *mineness* which only the individual can bridge to attain a full identity. Coming from another perspective (i.e. the one of Helmuth Plessner and Karl Marx), Hans Heinz Holz (2003) argues in the same direction when he states that anthropology has to be seen as having a dialectical structure, other than

a cybernetical (Rieger 2003).

Ignorant of these philosophical concepts, the bioscientific approaches trigger the view of regarding cells, tissues and organs of the own body as *self-units*. Objectifying bodies is not necessarily immoral. For instance when medical doctors make a biopsy, the self-units are objectivated, but nevertheless still belong to *me*. The diagnosis on terms of my tissues means something only to me, not to others. This argument seems to be plausible as long as there are two presuppositions clear: first, there have to be master units (e.g., the brain, or the gene), which regulate these self-units according to an overall body strategy of being alive and healthy; second, the border between the inside and outside of the body has to remain fixed.

Once the body parts are decorporated and freed of the personal self who generated them during growth, they are, I will argue, morally treated like plants. They are supposed to do exactly what plants do: grow, fuse, regenerate, proliferate and assimilate to a new context. They have no personal identity on their own.[2] In modern societies, they also have lost their own plant soul (lat. *anima vegetativa*) which Aristotle regarded to be the beginning of every kind of life. Keeping these plant potentials alive and productive is of major economic interest, while at the same time regarding the units possibly expressing these potentials as mere material objects. This reconfiguration of plant life can be the start of a process which Donna Dickenson calls "commodification of the body" (Dickenson 2007). Ironically, the plants lost their own soul and associated moral values due to the fact that since the Early Modern Period there was a both cultural and scientific focus on the body (lat. *corpus*) as *the* central unit of life. This filter both canalized comparisons between human body and animal body, and between human body and machine. The plant life thus became a modern utopia, since then it was not "real" life any more. Plants neither have fixed bodies nor central processing units of regulation.

Presently, plants are culturally treated as material without any intrinsic value, or any moral obligations we owe them. The same is true for body material, where the plant's hidden vegetative capacities of bones, cells and tissues are still useful, even if the body as a whole already is found to be dead, i.e. the capacities of animal and human life, for instance movement and perception, have vanished from it.

The strong alliance between plant cultivation and the cultivation of body materials can also be observed at the level of laboratory jargon. Biotechnicians *harvest* cells, Petri-dishes are *inoculated* with certain parts that should fuse with the cells (e.g., viruses as vectors), and in tissue culture techniques different kinds of *matrices* are used. The Latin word *matrix* is not only a synonym for the uterus, as in the narrower medical sense. Etymologically, it means the tree's mother stem, the trunk from which new shoots and seeds generate. Finally, the term "clone" is derived from the Greek, there meaning a shoot which came into existence by vegetative growth, i.e. asexually (by parthenogenesis). Looking at the international agrobusiness, plant biotechnology, and the efforts of patenting and trading seeds on global markets, there is a lesson to learn for the healthcare business. For instance, in the biocommercial agrobusiness-context it is now common to speak of "low-cost organisms", or "low-input/ high-output" organisms, or "low input/ high-yield-organisms". Moreover,

[2] There are, of course, approaches in Environmental Ethics, and Ecological Ethics to protect plants, as well as in Environmental Law. However, these approaches operate from an anthropocentric perspective with aesthetic values or concepts of biodiversity valuable for human life (incl. future generations), rather than with the plant as a special form of life (see Krebs 1997). The failure to include plants into the bioethical approach strikes back when we have to deal with early human embryos or coma patients, who remain in a vegetative state of life (see Karafyllis 2006a).

the property rights of highly optimized transgenic sorts and varieties are of crucial economic importance for the companies involved. The markets show a high elasticity, and the gap between demand and supply of food and fodder plants is large, and split into many poor countries as suppliers, and rich countries as buyers.

It is possibly useful for defending the argument that there is a strong connection between plant-related techniques and businesses related to the agricultural sector, and the healthcare sector dealing with decorporated body material, to emphasize the following: the old medical word for "implantation" of organs and tissues was "inhealing" (German: "Einheilung"). Rather than the input of body material into another person's body, it stresses the assimilative capacity of the own body to accept something new transferred.[3] When body materials such as tissues, organs, embryos and cells are transferred, they are expected to "inheal" somewhere else. Thus, they have to serve the healing of someone else who is not healthy. As the latter, the recipient is scientifically modeled as a human person who is mentally and physically ready to assimilate the epitomized body – the organs, tissues, or cells - of someone else, the donor has to be reciprocally modeled as mentally and physically ready to give his/her body parts in order to avoid a normative mismatch. What means "ready" remains obscure on both sides: Physically able? Mentally able? Desperate enough? Willing to pay/to be paid?

As the related examples of reproductive medicine, dealing with zygotes, embryos, egg cells and sperms, are obvious, let us look at the less obvious example of regenerative medicine (e.g. stem cell research), which is dependent on tissue culture and cloning techniques (Hauskeller 2002). For both somatic ("therapeutic") and reproductive cloning, egg cells are needed as living material. Cloning uses the totipotence of the undifferentiated cells during early embryo growth, i.e. before the embryo develops. It helps to make identical copies of a special self-unit, and to make it proliferate vegetatively. In many laboratories and clinics of the world, human egg cells are denucleated while the carrier of information, the nucleus, is put into another cell (nuclear transfer). Within the new boundaries, the nucleus has to be accepted and fused with the new context, to transform it into an optimized entity by the means of growth, e.g. a liver tissue grown from the first prototype. The hollow egg cell is useless, and treated as garbage.

The biotechnical fact that the (re)growing potential of many body parts can be regarded as female capacity, puts a feminist perspective, and, at the same time, a feminist ethics perspective on the agenda. Moreover, it touches the sphere of global justice as the body parts are sold as commodities on a global market, strengthening the disparities between rich and poor. The poor sell their body materials, the rich buy it. Donna Dickenson (2007; 2008) prominently analyzed the dependencies between female body materials, global justice and the cultural mentality of "body shopping".

We now come full circle. Aristotle argued that plant life is deeply related to the women's body. The potential of permanent regrowth showed in women's density of the hair, and in the constant renewal of the menstrual blood (gr. *katamenia*). Even though many of his misogynous findings are known, primarily due to modeling the cold and humid women as inferior to the warm and dry men, according to Aristotle it is *every* human being who has

[3] Regarding the ownership of plant, animal and human genomes, the patent regulation is still sticking to the ontological categories. In general, a patent only conveys certain limited ownership rights for a limited time. Unlike plant genomes, one cannot take out a patent on the entire human genome, or the genome of any animal, following the European Patent Office rejection of the Harvard oncomouse patent (NCK: I thank Donna Dickenson for this clarifying remark).

the vegetative soul still in his/ her belly, regardless of sex. Only in women it is revealed by their reproductive capacities. But even if Aristotle regarded plants to be living things rather than beings, this sight was not applied to the ontological status the vegetative soul has inside a human body. Activated by the male (gr.) *sperma* (in Greek meaning both semen and seed), which acts like a technician and organizes the blood in the uterus, the vegetative soul essentially belongs to this one being alone when the embryo starts to grow. It cannot be decorporated as its potential never ceases for this individual. It is needed to bring one's own potentials into existence.

So when we read in an article on human embryonic stem cells, in the German daily newspaper *Süddeutsche Zeitung*: "Small clots with great potential" ("Kleine Klumpen mit großem Potential", 21./ 22. May 2005 p. 5), the named potential refers to the totipotence known from plant cells, culturally attributed to women's bodies in general. In modern economic structures, the female body parts are not only attributions, but a reality in which foremost women are economically involved. Of course, the body of every human being has plant capacities to be harvested, and we all are "potential victims" (Dickenson 2007) of harvesters. It is the potential of living bodies which allows their owners to be potential victims of body selling, or worse: body stealing. And, after all, to be a victim of body buying, when the own potential of regeneration ceases. However, because of their reproductive bodies, women are more likely to become victims than men. Women's bodies are much more likely to become biofacts.

With reference to the high demand for egg cells, needed by researchers working, e.g., in regenerative medicine, and the need for an ethical approach that takes global justice into account, it is of little help to point out that the efficiency of cloning has increased in recent years. The possibility of getting one functioning clone is 1:100 – 1:300 egg cells used. In 2005, the research group of Korean scientist Woo Suk Hwang seemed to be able to reduce the numbers of egg cells needed for stem cell lines: He stated to have got 31 embryos out of 185 egg cells (Vogel 2005). In this case, the eggs seemed to be donated, not bought or sold. In fact, half of the actually more than 2200 eggs used by Hwang (instead of 185), were sold by Korean women, many of them now suffering from severe ovarian hyperstimulation syndrome (for details on the Hwang-case, see Dickenson 2008, chapter 4). In late 2005, the Hwang-case turned out to become one of the biggest bioscience fakes ever known, moreover it raised serious doubts about bioethics-committees, which in the case of Hwang, had agreed to his research (on the institutional dimension of bioethics, see Porz et al. 2007).

Donna Dickenson (2007), again, analyzed how in less regulated European countries like Spain, Cyprus and Rumania the demarcation line between *donating* and *selling* egg cells is about to vanish. As soon as profit-institutions are involved, the market for buying and selling body materials is open, and such is the price. A woman from a poor country could be, so to say, regarded as a low input/ high-yield body. Once her body material is implanted and grows in somebody else, no one will realize it. – "In fact, however, women in the West are also more likely to be organ donors than men. Living donors of a kidney were found to be disproportionately female in one US study – possibly because they were more likely than men to be asked, on the assumption that women should be altruistic" (Dickenson 2008, chapter 4, referring to the study of Zimmermann et al. 2000). As it seems, women are 'naturally able to give'.

Perhaps the future research will come up with the opposite idea: not the egg makes the body but the embryonic body makes the germ cells (gametogenesis) – without the economically inefficient detour of making a grown-up body. At least for mouse embryonic

stem cells this seems to work in the laboratory. Yayoui Toyooka and his group showed how so-called "knock in" embryonic stem cells could participate in spermatogenesis when transplanted into reconstituted testicular tubules, demonstrating that embryonic stem cells can produce functional germ cells *in vitro* (Toyooka et al. 2003). Karin Hübner and her colleagues respectively demonstrated oogenesis, i.e. egg cells produced by follicle-like structures which were generated from embryonic stem cells (Hübner et al. 2003). In a latest review of the mentioned techniques Harvard Medical School doctor, George Q. Daley, argues that even if the formation of primordial germ cells is robust, terminal gametogenesis remains inefficient and doubts about gamete function persist. Thus, clinical use of embryonic stem cell-derived gametes appears a distant prospect (Daley 2007).

Biofacticity, indeed, is pervasive. Its compounds to be fused are crossing borders in many respects (see Hauskeller, Manzei 2005). If the possible commodification of the body should be allowed or not, is an important point which, however, I cannot discuss in this essay. There remains no doubt that regulation of the markets is needed in order to prevent the poor from being exploited. Ethics cannot be limited to national boundaries, and to keep the own body in a healthy and productive state can be regarded as one of the basic needs both for the poor and the rich. Instead, I would like to conclude with the argument, that by using all living potentials as a technical and economical mean, the self-image of human persons is going to become fragile both in general, and in particular. This is because there will remain nothing left as unique nature, making up the sphere of own dominance over one's life. Perhaps the problem is the body perspective itself, and its cultural acceptance that there can be a fixed grown-up state which has to be maintained as "healthy". In this perspective, the cell is not only a self-unit, it is a miniature body, respectively named (lat.) *corpusculum* from the ancestors of biology. If, on the contrary, the own body is be regarded as belonging to a sphere of lifelong personal growth, including old age and death, then people will be more cautious in selling its material. This is because it is not just material, but an essential part of their own potentials which show their limits at the end of the own life.

5. Conclusion

In my essay, I wanted to stress that even if growth can be modelled with technical metaphors, models and apparatus in order to reach a uniform standard of certain growth *types*, the growth *token* in order to make it real still belongs to an uncontrollable sphere of nature. The potentials of living beings make up their essential difference to the technical sphere. Consequently, nature will not vanish, as it is often argued, but technology will be *disguised*. This veil of non-knowledge is a matter of critical reflexion of its own, but it already implies ethical questions. If I cannot perceive which kind of living products have been technically transformed into biofacts, how can I relate them to somebody who made them grow? If body materials just show plant capacities of growth and regeneration, should they morally be treated as plants? How can I decide if they should belong to myself or to somebody else? And which strategies of objectification and commodification are used to persuade me to selling my body materials, and buying those of others?

By application of new biotechnical developments, the technical modeling will more and more resemble the plantation and fusion acts of a gardener or farmer than the construction of an engineer. She or he extracts, implants and transplants in order to design a product. Plant capacities and (not only) women's body materials share a potential of fluidity and reproduction. The release of biofacts into the public sphere will have more anthropological

and ethical consequences than the ones which could be outlined here, especially concerning the idea of human (German: "Menschenbild"), i.e. human being, and the constitution of "the self" and "the other" (see Karafyllis 2007). Of crucial philosophical – epistemological, anthropological and ethical – importance remain all terms of modality which are involved in this discussion field: because what living entities actually *can* 'do' is found out by provoking them 'to do' something (e.g. to fuse, to proliferate, or to produce a certain amino acid). Nature's potentials of growth, proliferation and regeneration, are no statistical possibilities which can be overcome by laboratory practice, as the low input-high output balancing methods of bio-commerce envision. The potentiality of the term 'can' remains an ontological problem in the sphere of metaphysics. On the contrary, what somebody can do with your body material or the body material of others, should remain in the sphere of own dominance, keeping the need for global justice in mind.

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