The Political Economy of Umbilical Cord Blood Biobanking

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Abstract

In dealing with the clinical use of hematopoietic stem cells contained in Umbilical Cord Blood (UCB) for hemopoiesis reconstitution, numerous scientific articles recall that prior to acknowledgment of the potential of UCB for transplants, this tissue was regarded as a discarded human residuum. The transformation from waste to a valuable life-saving tissue is thus taken for granted in the biomedical literature. Firstly, in this paper, I critically investigate the socio-technical process by which this transformation occurred, drawing on the notion of bio-objectification (Webster 2012). I analyze how the transformation of UCB from a waste to a valuable tissue occurred through a two-way interaction between basic biological research and clinical settings. Secondly, drawing on the notion of biobanks as forms of governing life, I explore how differing institutional arrangements in UCB biobanking produce differing routes in UCB bio-objectifications, and different economic regimes of UCB exploitation—both of which are connected to differing ways of articulating the relationship between biomedicine and society. Finally, in order to rethink notions such as bio-economy and biocapital, I discuss how the co-construction of medical technologies, therapeutic applications, subjectivities, and social rationalities varies according to the institutional arrangements in which UCB bio-objectification takes place.

Introduction

Umbilical Cord Blood (UCB) contains stem and progenitor cells capable of restoring haematopoiesis. It is therefore currently used for transplantations in patients suffering from haematological malignancies, and immunological and metabolic disorders (Navarrete & Contreras 2009). The discovery that UCB contains haematopoietic stem cells (HSCs) dates back to 1974 (Knudtzon 1974), although the first successful UCB transplant was performed in 1988 on a paediatric patient with Fanconi anaemia, using UCB from a human leucocite antigen (HLA) identical sibling (Gluckman

et al. 1989). Today, UCB is considered a valid alternative to bone marrow (BM) transplantation for reconstituting haematopoiesis in both children and adults, and in the case of HLA mismatching settings (Kurtzberg et al. 1994). Indeed, while there must be histocompatibility of HLA system between the BM donor and recipient—making the search for a compatible donor a difficult and long procedure—the low rate of graft-versus-host disease documented in UCB transplants permits the transplantation also between partially mismatched donors and recipients (Rubinstein et al. 1998). Thanks to these features, the use of UCB in transplantation has increased over the years. According to Bone Marrow Donor Worldwide (the organization managing the registries of all HSC sources, including BM, UCB and peripheral blood), more than 20,000 UCB transplants were reported between 1989 and 2009, and more than 560,000 UCB units were stored in more than 100 UCB banks (2013).

Therefore, what 'was generally regarded … as a discarded human residuum' (Fernandez 1998, S84), is now considered a valuable life-saving tissue. The term 'valuable' is of key importance, because it refers not only to the clinical utility of UCB in transplants or in biomedical research, but also to its economic exploitation, and the related societal and ethical issues. UCB used in the clinical setting is not what was once discarded; rather, it is a *bio-object* (Webster 2012) fabricated in a complex, multilayered network of practices, procedures and institutions that (non-linearly) link the social world of basic biomedical research with that of clinics, and furthermore, with society at large.

The key node of this network is the UCB bank—the institutional site in which the bio-objectification of UCB takes place. It therefore makes this tissue available for its 'mobility across different socio-technical domains … [and] between different sectors or networks of society' (Webster 2012, 3), as well as for its economic exploitation. Indeed, there are two main institutional arrangements of UCB biobanking: the worldwide network of national public biobanks that manage the storage and distribution of this tissue for the public healthcare system; and the private sector, in which commercial companies sell to new and prospective parents the opportunity to store the UCB of a newborn child for future familial use. Thus, there are two different forms of economic evaluation of UCB. In

the public sector UCB is considered a public resource, which is collected through an act of donation, and supplied in a redistributive economy. In the private sector, UCB is regarded as a private biological asset, and UCB banking is advertised and sold to parents as a biological insurance against possible future illnesses in a market economy framework in which individuals negotiate with the emerging biomedical industry the exclusive possession on a corporeal commodity.

In this paper I shall explore how these two forms of UCB exploitation are connected to different regimes in the so-called bioeconomy, and thus how these regimes entail opposing modes of relation between biomedicine and society. Indeed, as Martin et al. have pointed out, UCB biobanking is a crucial site in which there occurs a co-construction of 'new promissory technologies, novel therapeutic applications, and new types of consumers motivated by changing moral imperatives' (2008b, 142). I analyze this co-construction in the two opposing institutional arrangements of UCB biobanking, and then consider the related social implications. To produce this study I conducted discourse analysis of articles published in scientific journals (retrieved in PubMed by searching 'Placental/Cord Blood banking'), on documents produced by bioethics and medical professional bodies, and corporate advertisements available on websites of private UCB banking companies.

Bio-objectification and the bioeconomy

Webster developed the concept of bio-objectification as a heuristic device to refer to the technoscientific creation of life forms and 'technologically enacted vital materiality' (2012, 2) in order to take into account the biotechnological transformation of life and its biological boundaries. Developments in biotechnologies and the life sciences have moved the control and manipulation of vital processes to the level of their cellular and molecular mechanisms (Waldby 2002): cells, tissues and biological information (such as gene sequences) are disentangled from their corporeal embodiments and transformed into technologies deployed in biomedicine, and in general, in the biotech industry. Webster, indeed, exemplifies bio-objectification,

and the biotechnological reformulation of the living, by showing how aborted fetal tissues, previously regarded as waste matter, 'can be revitalised as source material for stem cell lines' (2012, 2).

This biotechnological reformulation has given rise to new types of 'separable, exchangeable and reincorporable body parts' (Rabinow 1999, 95) which flow in international circuits and are exploited for the creation of bio-value—i.e. 'the yield of vitality produced by the biotechnical reformulation of living processes' (Waldby 2002, 310)—by a biotech field organized in 'corporate forms and context of research' (Sunder Rajan 2006, 4). Biosciences, therefore, are not only committed to the production of truth, but are increasingly dependent on the mobilization of venture capital through the 'patenting of cell lines, genes and transgenic organisms as inventions' (Waldby 2002, 310). Consequently, life has become 'productive of economic value … [and] the manipulation of life generates a value accorded to the enhancement of health' (Rose & Novas 2005, 455); and this 'relocation of wealth in the creative forces of human biological life' (Cooper 2008, 6) means that 'life becomes, literally, annexed within capitalist process of accumulation' (Ibid., 19). Bioeconomy and biocapital are thus terms intended to capture how bio-objectified entities (organs, tissues, cells, and gene sequences) 'are increasingly inserted into projects of product-making and profit-seeking' (Helmreich 2008, 464).

UCB represents a paradigmatic example of a bio-object, both because it has been transformed from waste into a clinically and epistemically valuable thing, and because it circulates internationally among countries and different social environments (laboratories, hospitals, biotech companies), thanks to a 'new medium of technical innovation,' namely 'biobanks or cord blood banks' (Webster 2012, 3). However, the bio-objectification of UCB does not automatically mean its commodification in a market (bio)economy framework, as the literature on bioeconomy and biocapital tends to postulate when pointing out that in any institutional arrangement of biomedical research 'it is the very definition of what constitutes market logic that is often most at stake in the strategic articulations of biocapitalism' (Sunder Rajan 2003, 92).

What I shall show in what follows is that the bio-objectification of UCB takes place within a particular socio-technical infrastructure, namely a

biobank, which connects different sectors of biomedical research with society, so that the institutional arrangement of UCB biobanking implies different paths, both in UCB bio-objectification, and in the economic exploitation of this tissue. What I shall show is that the co-construction of technologies, bio-objects, therapeutic applications, subjectivities, social solidarities and new rationalities of individuals varies within particular institutional arrangements regulating UCB biobanking. In other words, the market economy framework is not an inevitability in the current bioeconomy: it is only the outcome of a specific institutional arrangement, and other paths to bioeconomy are possible.

The bio-objectification of UCB

The umbilical cord as a site of haematopoiesis was discovered in the 1970s by Knudtzon (1974), who detected colony-forming cells in human UCB. Confirmation that UCB is an effective provider of HSC for haematopoietic reconstitution came only in 1988 when a team led by Eliane Gluckman transplanted UCB into a child in order to cure Fanconi anaemia (Gluckman et al. 1989). Interestingly, the laboratory-based confirmation that UCB contains HSCs well within the range of BM stem cells came just one year later (Broxmeyer et al. 1989, 3830). Smith and Thomson (2000) recounted the story of UCB science and clinical application in these terms:

> The study of umbilical cord blood began in 1982, when discussions between Broxmeyer and Boyse led to laboratory experiments that suggested that umbilical cord blood contained hematopoietic stem cells that might be suitable for transplantation ... This laboratory-based research led to the collection and banking at Indiana University in Indianapolis of cord blood from the siblings of children who were in need of transplantation. Gluckman et al in Paris were the first to use a sibling cord blood unit that had been banked by Broxmeyer at Indiana University to transplant a child with Fanconi anemia (Smith & Thomson 2000, 127-8).

Similarly, Gluckman (2009) described the clinical application of UCB as the outcome of the collaboration between the laboratory research of Broxmeyer and her clinical work. The interesting features of this narrative

are: (a) the intertwining between laboratory-based research and the clinical setting, and (b) the key role played by the banking of UCB.

The first point testifies to how the clinical application of UCB did not follow the linear model of translational medicine—which postulates a one-way flow from the bench to the bedside—but a two-way interaction between basic biological research and medicine, as described by Keating and Cambrosio (2001) in their study on cytogenetics. In several respects, the history of UCB science and clinical application resembles that of BM, where the first clinical trial was carried out in 1957 before the development of the biological knowledge of HSC, in what Martin et al. call a 'regime of hope', which proceeds 'on the basis of speculative potential therapeutic efficacy, even in the absence of a clear demonstration of underlying principles' (2008a, 32). In the case of BM transplantation, there was 'a clinically driven shift from the imagined possibilities of the clinic back into exploratory fundamental research' (Martin et al. 2008a, 33). Similarly, for UCB clinical applications, it was successes in transplantation that prompted the basic research on the features of stem cells contained in it. Indeed, the clinical application of UCB ran in parallel with laboratory-based research on HSC. At the bedside clinical haematologists demonstrated the therapeutic efficacy of UCB transplant also in HLA mismatching settings (Kurtzberg et al. 1994; Rubinstein et al. 1998); while on the bench experimental haematologists showed that, compared with BM, UCB contains a more primitive cell population that has more *in vitro* and *in vivo* proliferative potential (Hao et al. 1995), and developed methods to process and preserve UCB units while avoiding the loss of viable HSCs and the use of toxic cryo-preservants (Rubinstein et al. 1995). Therefore, the shift of UCB transplant from an 'investigational' procedure (American Academy of Pediatrics 1999, 117) to a routine clinical practice (Gluckman 2009; Navarrete & Contreras 2009) was prompted by this strong intertwining between clinical applications and laboratory-based discoveries. This two-way relationship between the bench and the bedside was made possible by a peculiar institutional setting: the university hospital, or the close association and proximity between clinical and research institutions. As in the case of BM transplant (Martin et al. 2008a), this proximity fostered collaboration between clinicians and scientists.

However, the development of both UCB transplant and UCB stem cell science would not have been possible without the establishment of UCB biobanks. Indeed, in order to be available for both transplantation and experimentation, UCB should be collected, tested, processed, preserved and distributed. Not only do UCB clinical application need biobanks, but also the study of HSC is carried out thanks to the UCB units stored. The first UCB biobanks were set up in universities and public hospitals during the 1990s, and knowledge on UCB stem cells and technologies with which to improve UCB clinical use and preservation were developed in these infrastructures. Therefore, UCB biobanks are both crucial nodes in the network linking biomedical institutions (laboratories, universities, research centers and hospitals), and the main sites in which the process of UCB bio-objectification takes place. Indeed, *biobanking* refers to the set of 'processing, testing, cryopreservation, storage, listing, search, selection, reservation, release, and distribution of cord blood units' (NetCord-FACT 2013, 8), whose outcome is the bio-objectified UCB unit as 'the end-product of a series of processes' (Ibid., 58).

The bio-objectification of UCB starts with the process of UCB collection at the moment of delivery. UCB should be collected by a trained obstetrician or midwife, in a way intended to maximize the volume of UCB while avoiding any possible risk for the mother and the child. Secondly, the collection procedure also involves a network of instruments and substances: UCB should be drained by gravity (and exploiting placenta pulsation), using a sterilized needle and a catheter, and it should be gathered in a blood collection bag containing an anticoagulant (NetCord-FACT 2013). Therefore what is sent to a UCB biobank is a tissue that is already partially processed. The second step of UCB bio-objectification is carried out in a UCB biobank, or in a set of UCB processing facilities linked to the biobank, and entails analysis of the UCB units (tests for genetic diseases and microbial contamination, cell count and cell viability assays, and HLA typing), and other UCB processing procedures (volume reduction and cryopreservation), both of which involve the use of devices and biochemical substances (centrifuges, cryo-protectants, freezing bags, metal canisters, and freezers with a monitoring system). When the processed UCB units are stored in a cryopreservation device,

the entire documentation, comprising both biological and technical information, is inserted into a database through a standardized system.

The UCB as the end-product of this socio-technical network of processes is something very different from what was once discarded: it is now a biotechnologically manipulated thing. In fact, after the bio-objectification involved in biobanking, UCB is made available for both clinical procedures and biomedical research. Moreover, UCB exists not only as a cryopreserved tissue in a freezer, but also as a set of information inserted in a database, which in turn is made accessible to an international electronic search system (like the international Bone Marrow registry, for example). Therefore, a UCB unit has two different ontological statuses: 1) as a processed tissue which is stored in a specific place (a UCB biobank); and 2) as a record of medical information which can flow in a transnational network of computer databases. When, through this informational network the UCB unit is identified as suitable for a transplant, also the tissue may flow transnationally in a network of UCB banks, hospitals, and transplant centers. It is worth noting that after the transplantation, UCB continues to exist with this double status: 1) as an engrafted tissue in the recipient (which has started to reconstruct hematopoiesis); and 2) as a medical record regarding the transplant and the process of engraftment, registered in the database of the biobank, and thus available to the scientific literature on the outcomes of cord blood transplantations.

Biobanks as interfaces between biomedicine and society

The UCB biobank is thus the key node in a network connecting hospitals (where UCB is collected), and universities and transplant centers (where UCB is used as an epistemic and clinical object). It is also the main site of UCB bio-objectification in which UCB is constructed both as an experimental and clinical object. Before exploring how the institutional arrangement of UCB biobanks defines the route of UCB bio-objectification, and thus its socio-economic implications, we have to clarify what biobanks are.

Put simply, biobanks are collections of human biological materials combined with information (personal, medical, genealogical, etc.), and

they are crucial sites within contemporary biomedical research (Gottweis 2008; Waldby & Mitchell 2006), since they provide researchers with samples and bio-information. Biobanks are not only techno-epistemic technologies linking several sectors of scientific research and the healthcare provision system, they are also a sort of socio-technical interface between biomedicine and society. As Gottweis and Petersen pointed out, biobanks

> … are a form of governing life and involve a multitude of actors such as scientists, patients, or industry who actively engage in building, describing and operating biobanks and who contribute to translating particular scientific-technological visions into material practices. … Biobanks always connect with society, culture, the economy and politics… and embed images of the patient, the citizen, collective identity and society (Gottweis & Petersen 2008, 9).

The ways in which a biobank restructures 'the boundaries between the scientific/technological, the social, the cultural, and the political' (Gottweis 2008, 22) depend on the institutional arrangements in which it operates. Gottweis and Lauss distinguish three different types:

(a) the entrepreneurial biobank model that is often carried out in a public private partnership between a commercially oriented entity and different state institutions;
(b) the biosocial model in which patient activist groups promote, fund, and facilitate the creation and operation of a biobank; and
(c) the public bio-bank model in which biobank networks are supported mostly through taxpayers' money and nonprofit research funding organizations (2011, 66).

Each of these types implies a different form of governance: a top-down model in the public biobanks, a bottom-up one in the biosocial, and 'horizontal exchanges between sellers and buyers, producers and consumers' (Gottweis & Petersen 2008, 8) in the entrepreneurial model based on market logic. This distinction is particularly important because it implies different ways to articulate the relationship among scientific research, the healthcare system, and the market, but also because it exerts effects on the articulations between biomedicine and society. Finally, it is crucial

because the debate on UCB rotates around two main models of biobanking: the network of public UCB biobanks for allogeneic donation, and the commercial sector of private banks for autologous or family conservation. These two arrangements imply different routes in UCB bio-objectification, which in turn entail different forms of co-construction of diverging forms of social bonds and opposing social rationalities.

The public UCB biobanking system

After the first successful UCB transplantation, researchers and clinicians started to establish biobanks for the storing of UCB units. The first public UCB biobank was set up in New York, by Pablo Rubinstein in 1991 (Rubinstein et al. 1994), and at the beginning of the 1990s others were established in Paris (Gluckman et al. 1993), London (Armitage et al. 1999), Milan (Lazzari et al. 1996), and in other Western countries.

From the outset, UCB practitioners highlighted the need for international cooperation and coordination among biobanks, clinicians, and researchers in the field of UCB transplantation and HSC science. The Eurocord group, an organization which promotes cooperation and higher standards in the field of UCB science, banking, and clinical application established the International NetCord Foundation, a non-profit association of UCB banks which has nearly thirty-five member banks and registries representing about fifty-one percent of the global supply of publicly banked cord blood (NetCord 2013). NetCord works both to connect biobanks—through an integrated database connecting multiple UCB banks databases worldwide—and to create standards and accreditation criteria for UCB biobanks. Together with the US Foundation for the Accreditation of Cellular Therapy (FACT) NetCord publishes a manual defining standards for UCB collection, processing, testing, and banking (NetCord-FACT 2013). The public UCB biobanking system is thus organized as an international network and it is sustained by an institutional architecture consisting of medical professional and governmental organizations.

Within this institutional arrangement, UCB is bio-objectified in such a way that UCB 'has gained new status as a natural resource' (Annas 1999,

1521). UCB practitioners consider UCB to be a human tissue, and so apply the rule that 'no part of the human body should be commercialized and that donation of organs or cells should be free and anonymous' (Gluckman et al. 1996, 108). Defining UCB as a public resource supplied and managed in a redistributive economy framework means that UCB donation is regarded as an 'example of altruism' (Annas 1999, 1522) 'for the benefit of society' (Pinch 2001, 59). In this sense, UCB donation is framed 'as a gift rather than a commodity,' and society can claim ownership 'to promote the common good' (Sugarman et al. 1995, 1784).

The public UCB biobanking system operates according to the logic of Foucauldian bio-politics of the population: it is a form of governing life that disciplines bodies (and their parts), regulates populations (Gott weis 2008), and creates an identification between 'the supply of blood, organs and other bodily fragments and the body politic as contained within the limits of the nation-state' (Santoro 2009, 18). As Brown has summarized, public UCB biobanking 'is promoted with reference to a solidaristic moral economy of gift and altruistic participation in imagined community and nationhood' (2013, 98). Indeed, public UCB biobanking also constructs subjectivities and social rationalities: citizens as part of the body politic are requested to contribute actively to the public good by donating UCB, and a redistributive tissue economy operates to sustain this social solidarity and bond.

Public UCB biobanking not only entails that UCB is a public resource for the good of the body politic; it also affects the ontological and technical status of the bio-objectified UCB. UCB is stored for use in its current applications, and laboratory research is carried out 'on the basis of current present-oriented "evidence-based" support for existing applications' of UCB stem cells (Martin et al. 2008b, 137). By contrast, in the private sector the autologous collection is not only aimed at existing applications in oncology and haematology, but also at the future prospect of regenerative medicine (Brown & Kraft 2006; Martin et al. 2008b). Accordingly, UCB processing procedures vary between the public and the private sector. Therefore, according to the institutional arrangement of UCB biobanking we find different epistemic and bio-objects (Santoro 2009).

The private UCB biobanking sector

During the 1990s, private biobanks were established in several Western countries. Martin et al. (2008b) counted 112 private UCB banks operating worldwide in 2008, which store some 881,000 UCB samples. These biobanks are commercial enterprises, which sell the possibility to store UCB for future use by the autologous donor (i.e. the child) or family members. UCB thus acquires a biovalue as a biological asset: it takes the form of economic capital for the private biobank, and of a speculative investment for parents. Indeed, UCB biobanking is defined by private companies as a 'biological insurance' (Wolf 1998, 5) or 'a form of property whose value is oriented toward the biological future' (Waldby & Mitchell 2006, 125). Indeed, by using expressions such as 'peace of mind' (Cryo-Save 2013), 'store your child's future' (Smart Cells 2013a) or 'put a little something away for a rainy day,' private companies try to induce new and prospective parents to invest in a technology that may, in the future, prove to save the life of family members (Brown & Kraft 2006, 314; Brown et al. 2006). As Brown and Kraft have pointed out, the language and metaphors of banking, investment and insurance refers not only to commercialization, but also to aspirational emotions, affectivity, expectations, and future health risks.

On the one hand, this future- and risk-oriented discourse is clearly linked to the neoliberal form of government that produces individuals who 'will govern themselves, master themselves, care for themselves' (Rose 1993, 291) through 'a kind of privatization of risk management … a calculative and prudent personal relations to risk and danger' (Ibid., 296). On the other hand, this discourse is built on notions of kinship responsibilities. Parents are encouraged to do something against some potential future loss or risks of future disease (Brown 2013): in other words, to take care of the futures of their family members. Brown and Kraft thus define autologous UCB preservation as a 'techno-moral entry point into an increasingly private linkage between parenting and biomedicine' with a 'set of "blood ties", reproductive duties and responsibilities' (2006, 325).

The private UCB banking sector is thus organized according to what Gottweis and Lauss (2011) term the entrepreneurial model of biobanking,

which is based on market logic and operates through exchanges between sellers and consumers. Indeed, the private UCB banking sector is characterized as 'a neoliberal privatised market where individuals or families make an exclusive claim on a ... biological asset that remains private property' (Brown et al. 2011, 1115; Santoro 2009). According to the neoliberal model of biopolitics and to a rhetoric of indemnity, insurance, and investment, this arrangement of UCB biobanking creates an ideal of a self-governing citizen who is responsible for the future health of his or her family and kinship, and who manages the health of his or her relatives in a market of biological services. It thus represents a particular articulation of the co-construction of medical technologies, subjectivities, and social rationality. Moreover, it entails and enables a different route to UCB bio-objectification.

Firstly, UCB in private biobanking is not a public resource but a private good, even if it is not properly a commodity. Indeed, as Brown (2013) has highlighted, parents pay a fee to retain proprietary control over an asset diverted away from the globally distributed public UCB exchange systems. For what is sold and bought is not the UCB units, but the storage service, which creates a form of possession excluding the commodity form: the value of UCB resides in its not being alienated, in its not having an exchange value (Waldby & Mitchell 2006).

Secondly, this private good or biological asset has a value which rests 'on the future-oriented promissory value of regenerative medicine ... embedded largely in future potential rather than present utility' (Martin et al. 200b, 132; see also Brown 2013; Waldby & Mitchell 2006). Indeed, in their advertising, private UCB biobanks report both the current clinical application of UCB, and the experimental setting and clinical trials using UCB for heart, lung, and liver diseases (Smart Cells 2013b). Some private biobanks, moreover, operate directly in the field of stem cell research and regenerative medicine (Bardelli 2010; Martin et al. 2008b). As mentioned above, UCB in the private sector is thus a different epistemic object, and it is bio-objectified according to a regime of hope—i.e. the expectations surrounding the future of regenerative medicine—and not to the regime of truth of established clinical settings in oncology and hematology in which the public UCB biobanking system operates

(Martin et al. 2008b). Therefore, in contrast to the public system, the institutional arrangement of the private sector implies a specific route to UCB bio-objectification that defines a different status of UCB—both as a good, and as an epistemic object for biomedical research—but also entails a different co-construction of subjectivities and social rationalities.

Conclusions

In this paper I have explored the bio-objectification of UCB, as it has been transformed from a waste material into a valuable life-saving tissue in clinics, and into an epistemic object in stem cell research. The bio-objectification of UCB has taken place through a two-way interaction between basic biological research and medicine by virtue of a particular institutional arrangement—that of university hospitals—in which different biomedical expertises cooperate. In this network of institutions and expertises, a key role is played by biobanks, which are both the strategic nodes of interconnection between biomedical institutions, and the material places in which the bio-objectification takes place. Therefore, I have analyzed two opposing articulations of the institutional arrangement of UCB biobanking which give rise to different routes to UCB bio-objectification. These routes are, furthermore, connected to different framings of UCB's status as both an economic good and an epistemic object, and therefore to different economic regimes of biovalue exploitation, subjectivities, and social rationalities. Indeed, biobanking is a form of governing life. Hence, different arrangements in UCB biobanking entail different models of biopolitics.

In the case of the public UCB biobanking system, UCB is bio-objectified as a tissue for its application in established clinical settings (a regime of truth), and it is defined as a public resource managed and exchanged in a redistributive bioeconomy according to a state-led biopolitics of the population, in which the individual body and its component parts are identified with the body politic, and citizens are constructed as individuals with responsibilities for the community's good. In this sense, donation is an altruistic act which creates social solidarity and cohesion, and reinforces social bonds.

In the case of the private UCB biobanking sector, instead, UCB is bio-objectified as a form of biological insurance—a private corporeal asset—oriented toward the future of regenerative medicine development. It is both a private good and an epistemic object for the regime of hope of stem cell research. Private UCB biobanking operates according to a neo-liberal biopolitics in which the citizen is constructed as a responsible, calculative, and prudent consumer under an ethical duty to take care of his or her kin, and who negotiates the health of his or her relatives in a market of biomedical services.

The case of UCB bio-objectification opens an interesting window on contemporary bioeconomy because it sheds light on diverging articulations of the process of exploiting biovalue. Indeed, it shows how different institutional arrangements can give rise to different forms of bioeconomy (a market vs. a redistributive economy) and, thus, how different routes to bio-objectification entail opposing models of governing life which imply the construction of diverging subjectivities and social solidarities and bonds. In this sense, the case of UCB invites us to explore how the market logic in the political economy of life itself is not an inevitability, but rather the outcome of strategic articulations of the actors involved, and of the institutional arrangements in which both bio-objectification and biovalue exploitation take place.

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