The Use of Analogical Reasoning in Umbilical Cord Blood Biobanking[1]

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Abstract In this chapter we investigate the roles that analogies play in the processes of understanding and managing umbilical cord blood biobanking. The objective is to unveil analogies' role as analytical devices in exploring the "being" of the new technology as well as their normative function in conceptualizing its characteristics and how it should be applied. We demonstrate how analogies have both explorative and argumentative functions, and how none of the analogies alone are able to address all the challenges raised by cord blood biobanking.

Introduction

Biological material has been used for medical diagnosis and biomedical research for a long time. However, the emergence of new technologies for analysing biological material to gain information for diagnosis and treatment choice, as well as methods generating new therapeutic products, has made such material much more salient within clinical practice and biomedical research. In addition, these technologies have made the commercial asset value of biological material much more visible.

New developments in biotechnology, such as therapeutic use of (pluripotent) stem cells has made the traditional distinction between organs, tissues and cells

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less relevant (Raymond et al. 2002: 257–265).[2] One area where such new technology has given rise to a series of new possibilities and corresponding challenges is umbilical cord blood biobanking. Some of these challenges will be addressed in what follows. Umbilical cord blood biobanking is an especially interesting case because the material in the bank is of potential future therapeutic value to both the donor and others while at the same time it is of potential value to science. Umbilical cord blood haematopoietic stem cells are used for treatment of a wide variety of diseases, and have become a viable alternative source of haematopoietic stem cells to bone marrow transplantation (Rocha et al. 2006). Cord blood can be used in autologous as well as in allogenic transplantations and has given rise to both private and public biobanks. The intention behind our exploration of umbilical cord biobanking is to uncover the way we try to handle challenges related to new technologies, and the prominent role which analogies play in particular. New technologies pose fundamental questions of what the technology *is*, its correct understanding, and how it should be applied. We aim to show that we use an assortment of analogies to address the complex ontological, epistemological and ethical questions surrounding biobanking in its modern and technology-driven form, and that no single analogy seems able to cover the whole field on its own. What then are the main questions posed by biobank technology?

Big Challenges with Small Amounts of Blood

Within umbilical cord blood biobanking, i.e. the procurement, storage and use of umbilical cord blood, we are faced with a series of pertinent normative questions. The following list of questions is not exhaustive, although it may be exhausting. However, it illustrates how broad and deep the challenges are. Some of these questions relate to the issue of what biological material is; e.g. is it part of a person, and who owns the blood, the child, the mother or the parents (Lind 1994; Sugarman et al. 1997b; Zilberstein et al. 1997; Munzer 1999; Kline 2001; Dame and Sugarman 2001)? If it is conceived of as leftover or byproduct, what kind of rights does the child and its parents have with respect to umbilical cord blood (Knoppers and Laberge 1995), and does this depend on our understanding of the production process of which it is a byproduct? If they do not have property rights, do they have other rights with respect to accessing this material (in terms of stem cells, other umbilical cord blood products or information derived from these products)?

Other issues are related to challenges of regulation and management. For example, if the cord blood has potential for commercialization and commodification, how should this be regulated? Should biobanks be governed by the invisible hand of the market or should there be equitable profit sharing (Merz et al. 2002) and just distribution of estimated or actual outcomes (Merz et al. 2002; Smaglik 2000)? May biobank material be sold (across national borders) or is commercialization of such material unacceptable in principle (Holm 2004)? Should there be control of downstream use and patenting (Merz et al. 2002), and how should one avoid exploitation

[2] It is interesting to note that blood itself poses some of the same challenges: is it an organ or a cluster of cells?

of persons in a vulnerable situation, e.g. persons contributing to research or persons belonging to disease-associated advocacy groups etc. (Merz et al. 2002)? Moreover, what is the proper form of advertisement, if any? Is it correct to call paying for storage of umbilical cord blood "biological insurance"? What actually is the relationship between the clinic with its personnel and the company (agent or contractor) storing and analysing the biological material? In the case of private umbilical cord blood biobanking, what happens to the blood if payments are not made? Should the material and the information derived from it be given back to the donors, be destroyed or become property of the company or of national health authorities or should it be given away freely to research and/or technological development?

Moreover, how should the relationship between a donor and a receiver be conceived of in cases of life-saving donations? If one gives away something that may be of vital value to oneself to someone who needs it desperately, should one then be entitled to know the receiver? Conversely, if one receives something of potentially vital value, why should one then not be allowed to know who the donor is (to express thanks)?

Furthermore, how should risks related to donation from biobanks or the use of products developed from biobanks be handled? In particular, how should risks to the recipient in cases of "donor" diseases (HIV, genetic disorders) or disclosure of unwanted knowledge be handled (Sugarman et al. 1997b)? How should one deal with situations of insufficient minority representation (Ballen et al. 2002) or genetic discrimination (e.g. if not everybody is allowed to store umbilical cord blood in the bank)? Additional issues concern how to regulate alternative uses of biobank material (e.g. for forensic purposes, or for the purpose of gaining genetic information in the context of insurance or employment).

Other issues more directly address moral values and principles, in particular respect for autonomy, but also privacy and confidentiality issues (Burgio and Locatelli 1997; Sugarman et al. 1997a,b; Burgio et al. 2003). Is it possible to obtain informed consent from persons donating material to an umbilical cord blood biobank (Vawter et al. 2002), and can the consent be adequate (Hoeyer et al. 2005; Sugarman et al. 2002)? How is it possible in advance to inform about and handle perspectives of cost-benefit, when we at present do not know the future utility-potential of the procured and stored material? How should one address the implications of information overload, e.g. the situation in which "if subjects are too well informed they'll be less likely to participate" (Merz et al. 2002: 172). And what about the problem of directiveness of information when private or public umbilical cord blood biobanks seek to enrol new "clients" (Sugarman et al. 2002)?

Furthermore, should withdrawal from the bank be conditional or unconditional? Can the biological material be kept if it is anonymized, or does it – after withdrawal of consent – have to be destroyed? What about results and information gained from the cord blood? Are contributions to such biobanks made voluntarily or are they subject to undue influence (Nelson and Merz 2002)? How effective is the protection of research subjects (Annas 2001)? Moreover, how should the connection between health registers, genealogical databases and biobanks be handled? How should one handle genetic information about a child and his/her family in order to protect privacy and confidentiality (Askari et al. 2002)?

As indicated, this list of questions is by no means exhaustive. The reason the list is made so extensive is to illustrate the complexity of the field and the diversity of challenges we face, and the variety of interconnections that exist between these questions. The cases make it clear that the ontological question of what biological material *is* and the epistemological question of what the status of the knowledge that stems from such material is, are related to moral issues, such as whether we have property rights, whether it should be shared with others, and whether we should be protected against misuse. Furthermore, as the questions are interrelated, so are their answers.

Correspondingly, some of the questions raise general issues in relation to blood cord biobanking, whereas others are typical to a particular use of biological material (e.g. to allogenic use of cord blood, to private use, or to research). Hence, particular uses of biological material call for special ways of understanding and managing biobank material.

Before we analyse which analogies that have been applied to address these challenges, we will make a short contextual remark. It can be that the "commercial banking analogy has already become indispensable" and that it overshadows other analogies (Burns 2006: 49). In Europe the final form of umbilical cord biobanking is not settled yet. It is also important to remember that blood banking in Europe is almost exclusively public and does not involve payment to donors. Although we acknowledge that the commercial banking analogy is a central player in the field of biobanking and that it may continue to play a crucial role in future attempts at investigating the ethical, legal and social challenges raised by biobanking in its different modern forms and formats, we want to show that other analogies still play important roles. Moreover analogies tend to be applied (normatively) in US cord blood legislation (Neal 2006).

Analogies Applied

One forceful analogy that has been applied to address some of these issues is that of waste (Gluckman 2000; Senior 2001; Harris 2005). More specifically it has been used to handle issues such as "left over", commodification and enrolment. If biological material is perceived as waste, it becomes easy to make people give it away (for research or therapeutic purposes). Others have used the analogy of waste that is transformed into gold (Annas 1999) to put emphasis on the changed status of the material due to the emerging technology. Moreover, umbilical cord blood has been compared to natural resources (Senior 2001) to further highlight certain aspects of the (economic) value of biomaterial, while implicitly de-emphasizing other aspects. This analogy covers both the issue of property and/or ownership, commodity and justice and to a certain extent also that of autonomy.

Others have applied the analogy of organ transplantation. One implication of this has been to put emphasis on the *history* of invasive procurements:

> Placental blood is described as useful for the transplantation of stem cells. This phrase implies that the model [analogy] of organ transplantation should be adopted for the collection of placental blood. This similarity is perhaps natural, because historically the transplantation of bone marrow (the chief source of stem cells) has itself been treated as analogous to organ transplantation (Annas 1999: 1521).

Another implication of the organ transplantation analogy has been an emphasis on *consent* issues and on *living* donor-safety issues: "Thus, if we adopt the transplantation model for placental blood, *we are likely to focus on the risks to the donor and forbid commerce and sales*" (Annas 1999: 1521, emphasis added). A third implication is that the use of this analogy has led to vilification of any *commerce* in relation to umbilical cord blood:

> . . . we prohibit the purchase and sale of human organs because we think these practices put donors at risk from potentially coercive monetary inducements and also because we highly value the "gift relationship" in organ transplantation as a rare and praiseworthy example of altruism (Annas 1999: 1521).

Finally, the organ transplantation analogy has appeared to be useful in dealing with property issues as well as issues of commodification and of cost-benefit. Blood transfusion has been used as an analogy to highlight issues of risk, property and commodity. The implication of this analogy has been a down-scaling of the risk of donors as well emphasis on *product* safety issues. Besides, it has been argued that the use of this analogy may help to legitimize *some* commerce in placental blood (Annas 1999).

Other analogies have been applied to address other challenges; only some are discussed briefly in what follows. Commodity itself has been used as an analogy to address the issue of profit (Nelkin and Andrews 1998; Cohen 2000; Munzer 1999), and the stock market (Merz et al. 2002: 969) has been applied as an analogy to highlight many of the issues related to economic values, autonomy and risk. Fetal tissue donation, e.g. using aborted fetuses for research or therapy, has been used as an analogy to emphasize ownership and/or property issues, issues of consent and decision-making authority as well as safety issues with respect to potential receivers of umbilical cord blood (Annas 1999). The gift analogy has been used to emphasize that donation represents a "rare and praiseworthy example of altruism" (Annas 1999: 1521). Also the analogy of sponsoring (Merz et al. 2002) has been applied to put emphasis on altruism, as well as to address autonomy and property issues. The recycling analogy (Senior 2001), on the other hand, has been applied to address issues of property, cost-benefit and risk. Viewing human tissue as one's home, extending one's own identity, has been used to argue for strong protection against invasions of privacy, whereas analogies of a public office have been applied in order to argue that biobanks are jointly built institutions for co-operation and common use (Eriksson 2003: 183). Figure 1 gives a short overview of the analogies and some of the challenges they are made to address.

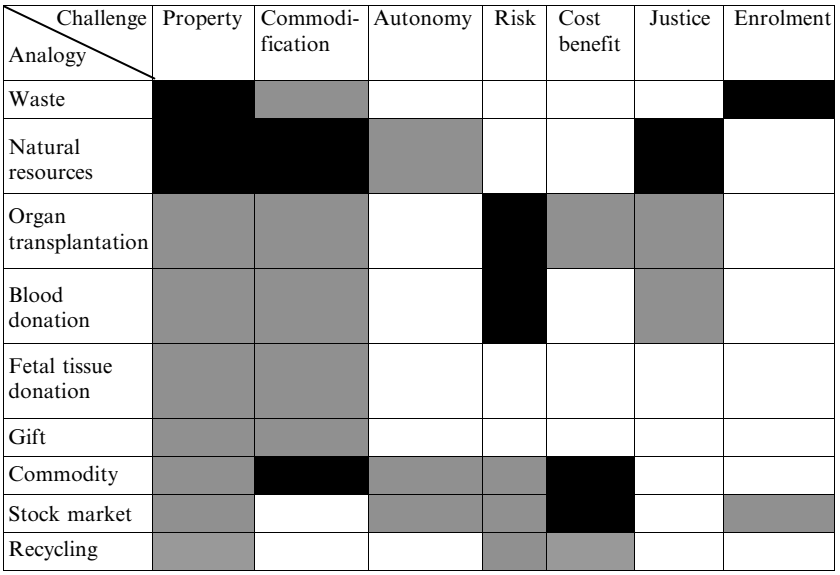

Fig. 1 Some prominent analogies in the umbilical cord biobank debate (*rows*) and a tentative graphic outline of which challenges (*columns*) they address. *Black* indicates that the analogy addresses the challenge directly, *grey* that it addresses it more indirectly, whereas *white* indicates that the challenge is not addressed by the analogy (The graphic representation is inspired by Annas 1999.)

Analogical Reasoning

As was the case with the list of challenges raised by umbilical cord blood biobanking, the list of analogies presented above is by no means exhaustive. The overview of which challenges the various analogies have been used to address is at best cursory. Other analogies could have been applied for the same purposes, and the same analogies could probably have been used for other purposes as well. Nevertheless, we hope that our list and overview above have been able to demonstrate that analogies play an extensive role in the debate on how to appropriately understand and cope with umbilical cord blood biobanking and other forms of biobanking. From this at least five preliminary conclusions may be drawn.

First, not only do analogies change with new technologies and altered practices, but technologies and their practices change by dint of the use and promotion of analogies.

Second, analogies may not only serve as useful analytical tools in illuminating the normative terrain of research biobanking; their uses are in themselves normative. In this respect they may be said to have two functions, one *analytical* in the strict sense of the word and one *argumentative*. That is:

1. Analogies are applied in order to explore or analyse a certain issue, e.g. to sort out the ontological status of biological material, how to conceive of the knowledge

that stems from it and to map how we should actually act with respect to such material.
2. Additionally, analogies are applied in order to argue for certain conceptions and ways of handling the issue under scrutiny. That is, analogies are used to explore and map out the normative terrain of biobanking as well as to make normative claims.

Third, analogies are not exhaustive. That is, individually they are not able to deal with the full complexity of challenges that may emerge within a technology-driven field such as biobanking. Each analogy tends to have a restricted reach with respect to how many challenges they are able to address. Consequently, many analogies seem to be at play at the same time, even if one is to address one particular field, such as publicly funded umbilical cord blood research biobanks for allogenic use (Samuel et al. 2006). From this seems to follow that the function of analogies should be assessed from a variety of different angles and by the use of a variety of different parameters. Figure 1 gives but one account of such an assessment (with respect to the analytical function). However, it is quite clear from the analysis of analogies that only with great difficulty can such an assessment take place without becoming in itself argumentative (and normative).

Fourth, the relevance of analogies seems to be time-dependent, i.e. they tend to be more important at the emergence of a new technology. However, when the technology is conceptually settled, their relevance seems to decrease. In fact, the technology in question may itself become an analogy for other emerging technologies.[3] One of the reasons why we can still explore the analogies used in debates about umbilical cord blood biobanking is probably that this is a technology still in its infancy.

Fifth, part of the argumentative value of analogies is rhetorical. Many of the analogies used are value laden, and if I can convince my interlocutors to accept a particular analogy as a good analytic tool, I may also convince them to accept the valuation implicit in the analogy. A prime example is the analogy of "waste" which implies a low valuation of the material denoted as "waste" and a tendency to obscure the fact that some kinds of waste are extremely valuable even to the waste producer (e.g. the heat generated by the incineration of household waste is itself a kind of waste, but still valuable if used for central heating). That is, there is a relationship between the analytical and the argumentative roles of analogies, as noted previously. The acceptability and relevance of the explorative function of an analogy may increase its argumentative power.

Additionally, the selection and promotion of analogies has a normative function in and of itself. Because certain analogies are more suitable to emphasize particular aspects of a technology they will be more efficient in promoting certain conceptions and actions. Hence, an analysis of the application of analogies can be used to reveal and critically assess the vocabulary and the prevailing positions in the field of biobanking.

[3] For this, see also chapter "Mapping the Language of Research Biobanking: An Analogical Approach".

Analogies Explored

There is of course a wide variety of analogies not mentioned above that could be fruitful and interesting to apply – and which to date has not been applied – in discussions about umbilical cord blood biobanking. Here we suggest assessing the relevance of a set of self-interest-based and conscription-based analogies.

Commercial Banking

The first similarity between commercial banking and research biobanking relates to the notions of "input" and "output". One invests resources (biological material, money), and receives a return that is dependent on factors that are external to the investment. In commercial banking the output depends on the type of bank account and the interest rate, which in its turn depends on market factors.

In treatment biobanks, the output strongly depends on what kind of biobank holds the umbilical cord blood. If it is a private biobank where no other person other than the parents or the child can make use of the deposit, then the "interest" depends on the health of the holders of the "bank account". If they are healthy, there is no pay-back. However, if they in the future are afflicted by certain diseases, they may have an immense return. Therefore, it may be argued that a safe-deposit box – or maybe an insurance – analogy is more appropriate in this situation.

In contrast, if the blood enters a general pool where whoever fits certain criteria can receive it, and where one can get matching blood if one is in need, the situation complies very well with the commercial bank analogy. When we put money in the bank, the use of this money is beyond our control. However, the return is regulated. In the same way that it is not one's original money one gets back, it will normally not be one's own blood that one will receive. As when one puts money in the bank, one runs a risk (physical or social), and one may receive interest (profit).

In research biobanks for umbilical cord blood, the output strongly depends on the terms under which biological material is entered (e.g. whether the person is identifiable or if material is entered anonymously). In any case, the repayment is in terms of knowledge that can become of vital importance in the future or in terms of therapeutic uses. In the case of anonymous contributions, the repayment is knowledge and therapy in general. With identifiable contributions, the profit can be more particular in terms of knowledge or therapy that is of importance for the "account holder", e.g. by revealing important information about hidden diseases that can be treated or information about preventive treatment of dispositional conditions. One interesting issue is whether knowledge is the only currency for repayment. The banking analogy poses the question whether other kinds of repayment than money could be relevant. This leads to another aspect of the banking analogy: the practice of currency exchange.

The banking analogy can also be used to explore transactional issues. There may be many reasons for wanting to exchange biomaterial (and related information)

within as well as across national borders. The pertinent question is how are we to conceive of and conduct such exchanges. One perspective would be to apply the analogy of currency exchange. If the biobank material has a certain value, one could argue that it could be converted into bio-currency, a notional token of its potential value. Correspondingly, one could argue for conversion of diagnostic bio-currency into research bio-currency and bio-currency to (analysed) data-currency.

This also opens up for the analogy of a savings account, where one could have an annual or monthly bank statement telling how much one's contribution is worth at present, or a tissue statement giving information on how many items are available, or what kind of knowledge has come out of the cord blood deposit so far. As many (grand)parents used to open a savings account for their newborn (grand)child, parents can now open a "research biobank account" for their newborn child. Accordingly, the money (i.e. the actual tokens) entered in a savings account would not be the same money one gets back. This would also be the situation in the case of a large common therapeutic cord blood biobank, i.e. one would get cord blood back on request, but not the same blood as entered.

In any case the analogy makes it clear that there is a repayment that depends on external factors as well as on the success of the bankers, that there can be an exchange of value, and that it is not the same item of value (money) that we deposit, which then later is returned to us. Additionally, the analogy highlights that there is a small risk related to depositing one's valuable items.

Insurance Analogy

Private companies for commercial umbilical cord biobanking have argued forcefully that what they offer to parents is "biological insurance". However, the explorative function of the insurance analogy has not been utilized at any depth. It is quite clear that the insurance analogy is relevant for the autologous therapeutic cord blood biobank. One deposits umbilical cord blood in the biobank and if something happens, e.g. if one gets a particular disease, one is entitled to a substantial "insurance payback". The payback is fixed according to available technology for diagnosis and treatment, and the benefit can be life saving. The insurance fees, which come in addition to the contribution of the cord blood, are regulated by the number of "insurers", as with many kinds of insurance in general. However, whereas insurance fees are usually risk dependent (e.g. young men pay more for motor insurance), the fee for cord blood biobanking is fixed.

With cord blood, the risk assessment is that about 1:20,000 healthy persons will gain from umbilical cord blood in the future (Brinch et al. 2004), but as with insurance in general, this is prospective and speculative. We still do not know much about how this blood will be used in the future.

Although this is the most obvious application of the insurance analogy, one may argue that although it highlights the risk aspect, it does not address the risk-spreading aspects of insurance. This aspect may be more relevant in research

biobanking where the "insurance payback" is not the same cord blood, but knowledge that derives from research performed on such material, and that can become of vital value to each person contributing. If the contribution is anonymous (anonymized), the "insurance payback" is in terms of general knowledge. If the "insurance holder" is identifiable, the "insurance payback" can be more specific. The knowledge gained by the research project can be of vital value for him or her. However, the exact payback is not known when entering into the research, as it is the new knowledge (the "payback") that is the aim of the research. As with regular insurance, you do not know whether you get anything back, actually you hope that you will not (need to) get anything back, and if you get a payback, it may be quite different from what you put into it.

Moreover, it is worth noting that insurance is based on well-known probabilities, and that it is mono-axiological: it focuses only on economical value (including the economic value of uncertainty). This appears to be different with biobanking: the probabilities that you will need knowledge resulting from biobank research are not well known, and the values involved when you need it are certainly not only economic (or easily exchangeable to economic values). These aspects may make the gambling analogy more suitable.

Gambling Analogy

The gambling analogy highlights the aspect of uncertainty in the same way as the insurance analogy without, however, necessarily quantifying the uncertainty. A gambler enters the game because he wants the outcome (and for the fun of it) but seldom on the basis of risk-spreading calculations. Hence, one can enter cord blood into a biobank in order to hopefully win the big prize (life and health or important knowledge).

Correspondingly, a national lottery may be a relevant analogy for cord blood biobanking. In a national lottery you make an explicit contribution and whether you will win (or gain) is a matter of chance. If you win, the gain is substantial, but most people are aware of the chances being very small. In the Norwegian national LOTTO, the chance of winning any prize is 1:138 and the chance of winning the first prize is 1:5,400,000 and the maximum gain so far has been 1.3 million USD. Although the chance of winning (a high gain) is small, for most people the price of the lottery ticket is small as well. That is, the risk which they take is small, no matter how high the gain may be. Furthermore, some gamble in national lotteries not only because they hope to win, but also because they know that the earnings from the lotteries go to common causes (culture, education and sports in Norway). Hence, the gambling analogy also helps to unveil the role altruistic motivations may play in biobanking.

The national lottery analogy is also well suited to bring forth the uncertainty aspect of biobanking, as well as the low risk aspect and to a certain extent also the issue of enrolment. However, other challenges with umbilical cord blood biobanking are less well addressed.

Membership Analogies

Another analogy that may be relevant is the membership analogy. Although Merz et al. have addressed the issue of interest groups (advocacy groups) promoting recruitment for certain biobanks (Merz et al. 2002: 970), the analogy has not been fully explored. There appear to be other potentials embedded in this analogy. We can compare the participation in a research project conducted on umbilical cord blood to becoming a member of an association with a defined goal with which we identify. As a member of Amnesty International in a country with few political prisoners, one enters the organization motivated by ideas of freedom of speech and fair trial, and hopes that, as a member, one can contribute to these goals. As a member, one may receive information about the work of the organization and one may have some membership advantages. The membership (as well as the work) is voluntary and one has no property rights with respect to its results. The results may not be sold and enrolment is achieved by advancing information about the organization and by advertising.

Correspondingly, the enrolment in an umbilical cord blood research biobank may be conceived of as a membership, where one pays a membership fee, receives membership information and has certain membership advantages. One may not claim any property rights to the results of the research, or one may have a certain sharing in the results. Moreover, the membership analogy may be relevant to therapeutic blood cord biobanks as well. In this case, analogies of membership giving certain advantages may be more relevant than analogies of membership in ideal organizations. Several for profit clubs may be relevant, depending on whether the biobanks are for autologous or allogenic uses of cord blood.

Other relevant membership analogies are clubs (e.g. sports clubs, book clubs) and interest groups (e.g. environmental organizations). A particular kind of membership is related to organizations with compulsory membership, such as (in some countries) labour unions, health insurance organizations and military service organizations. Contribution to a common good is made compulsory in many aspects of life, and one could of course argue that donation of umbilical cord blood is an activity of this kind. Hence, donation of cord blood could be conceived of as a compulsory contribution to the common good. It is interesting to note that analogies of compulsory membership will presuppose that the gain from such a membership is substantial or that the cost is low, in order to legitimate its compulsion. The analogy of compulsory membership will therefore fit well with analogies such as waste, where the cost is low.

Another related analogy is the stewardship analogy. This analogy could be useful to highlight common ownership of umbilical cord blood, as it is not obvious whether it is the property of the child or the mother. A third party is entrusted the careful and responsible management of the biological material. The analogy of stewardship could be relevant both to research and therapeutic biobanks.

Thus, some membership analogies may be better for exploring research biobanking of cord blood (the first “common goal” analogies), whereas others may be

Challenge / Analogy	Property	Commodity	Autonomy	Risk	Cost benefit	Justice	Enrolment
Normal Banking							
Insurance							
National lottery							
Membership							
Conscription							
Stewardship							

Fig. 2 Self-interest analogies and conscription analogies and their ability to address the challenges with umbilical cord blood research biobanks. The assessment is by no means absolute, and is only used as an illustration. *Black* indicates that the analogy addresses the challenge directly, *grey* that it addresses it more indirectly, whereas *white* indicates that the challenge is not addressed by the analogy

better for exploring therapeutic biobanking (the latter "common activity" analogies). The features of new self-interest-based and conscription analogies are summarized in Fig. 2.

Concluding Remarks on Analogies to Analyse and to Argue

This chapter has reviewed a complex set of challenges related to umbilical cord blood biobanking and identified a whole range of analogies that may be used to address these challenges. Moreover, we have investigated a set of analogies that have been absent in the debate on umbilical cord blood biobanking, and indicated that these analogies may be fruitful for exploring (and arguing for) certain conceptions of biobanks so far ignored.

Our analysis has demonstrated that the analogies have both an analytical and an argumentative function. They are used to explore important issues in order to establish a conception of the biobank and to argue normatively in favour of particular conceptions and conducts with regard to banks of this kind.

Furthermore, analogies address ontological, epistemological as well as moral challenges raised by new technologies. Some analogies appear to be more appropriate for addressing and arguing for specific issues, e.g. regulation and management, moral issues and issues of ownership. Correspondingly, analogies are more or less appropriate for handling various aspects of umbilical cord blood biobanking, such as allogenic versus autologous uses, use for research or therapy, private or public uses etc.

Our analysis has shown that any single analogy is unable to address the complexity of challenges involved. On the other hand, analogies can fruitfully be combined

in order to address various challenges (Hofmann et al. 2006b). And some analogies prove easier to combine than others, according to whether the issues they address are complementary; e.g. conscription analogies are easier to combine with the waste analogy than with commercial banking. This also shows that analogies that do not fit together because their conceptions or arguments conflict, and that analogies which do not address the issues that are conceived of as relevant and pressing, may be seen as less appropriate or be used as disanalogies.

Consequently, it seems justified to conclude that a variety of analogies are needed to cover the troublesome complexity of the field. Besides, restricting oneself to one analogy in order to understand and argue for a certain way of handling a technology may restrict our conceptions and actions. In order to thoroughly explore a technology, a variety of analogies should therefore be applied. This appears to be most important at the emergence of a technology, that is, before the technology in question has reached a state of conceptual saturation and fixture.

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