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THE RECONFIGURED BODY

Human–animal relations in xenotransplantation

The article explores issues concerning the reconfiguration of human and animal bodies in modern biotechnology. The examples are based on xenotransplantation: Transplantation of cells, tissue and organs from animals to humans. Three thematic issues that emerged from xenotransplantation research in Sweden in the 1990s and early 2000s are examined in the article. The first issue concerns how the pig was introduced as a donor animal in xenotransplantation and, at the same time, dehumanized in relation to what is human. Baboons and chimpanzees that had previously been used in xenotransplantation now became an ethically problematic choice, and were in stead humanized. The second issue concerns the introduction of transgenic and cloned pigs as commoditized objects. The biotechnological development reconfigured the pig's cells, tissue and organs to become more human-like. The third issue concerns the risk that pigs contain retrovirus that could infect the transplanted patients. The human body became part of a network of both animal and retrovirus. Boundlessness between human and animal bodies appears in these three thematic phases and is analysed from a cultural perspective.

Introduction

Modern biotechnology is a central field where different biological objects are reconfigured in a creative act. Examples are gene and stem cell technology, which have created new values of objectification and materialisation of the human body, as well as new and expanded markets for the biotechnology industry. The relation between medical research and industry has not only produced new diagnostic methods and treatments, but has also projected the scientists' values onto the public, in regard to how they relate to the human body.[1] Biotechnological research provides a good opportunity to study, from a cultural perspective, how new technologies reconfigure bodies into new states.[2] In the article, the term 'reconfiguration' is used to study the evolving relationship between human and animal bodies, and how these bodies alter the manner in which we might refer to them.[3]

The article is based on a study of Swedish scientific work with xenotransplantation in the 1990s: A biotechnology where cells, tissue and organs from animals are transplanted to humans.[4] The Swedish case is used to study how the field of xenotransplantation evolved in the 1990s, as well as how human and animal bodies were reconfigured in the process.[5] In xenotransplantation, this reconfiguration concerns not only the human body, but also the animal body, which is produced and recharged with new values and new understandings.[6] This is evident in the perspectives taken by actor-network theory (ANT), where the nonhuman actors; animal cells, tissue and organs, have an energy that can affect human actors.[7] As researchers transform and transplant these nonhuman actors to patients, the patient's body becomes a part of a wider network of other actors, and it is within this wider network that the relationships between different bodies are

1 Martin 1994.

2 Gilbert 2008; Lederer 2008.

3 Berg and Timmermans 2000; Bowen 2005; Olesen and Markussen 2003.

4 The article reports on work carried out as part of the project 'Impact of Citizen Participation on Decision-Making in a Knowledge Intensive Policy Field' (CIT-PART, Project Nr. SSH-225327), which is funded within the 7th Framework Programme from 2009-2012. I thank the European Commission for their generous support of this research project. More information is available at the project website <www.cit-part.at>.

5 In the beginning of the 1990s Swedish researchers were at the forefront of international xenotransplantation research. At Karolinska University Hospital, researchers carried out clinical trials in which ten patients with diabetes underwent transplant surgery with pig cells producing insulin. At Sahlgrenska University Hospital, Gothenburg, researchers carried out two clinical trials where a pig kidney was connected to a patient and the human blood streamed through the kidney. At the time Sweden had between 10 and 15 scientific groups that were working in international networks within this medical science. For a presentation of the development of xenotransplantation in Sweden and internationally, see Brown and Beynon-Jones 2010; Deschamps *et al.* 2005; Lanza and Cooper 1998; McLean and Williamson 2005; Persson and Welin 2008; SOU 1999:120.

6 Fox 2005; Twine 2010.

7 Berg and Timmermans 2000; Latour 1992.

challenged. The human and the animal body are in this way not fixed and stable objects. Instead these bodies are seen as active surfaces where different biological and cultural forces have the possibility of interconnecting with each other.[8] *The reconfigured body* is an actor that is affected by other human and nonhuman actors in unstable networks.

In the article, the reconfiguration of human and animal bodies is studied through three different thematic issues of xenotransplantation research conducted in Sweden in the 1990s and early 2000s. The first issue concerns how the pig was introduced as a donor animal in xenotransplantation and, at the same time, dehumanized in relation to what is human. Baboons and chimpanzees that had previously been used in xenotransplantation now became an ethically problematic choice and were conversely humanized. The second issue concerns the introduction of transgenic and cloned pigs as *commoditized objects*. This biotechnological development reconfigured the pig's cells, tissue and organs to become more human-like. The third issue concerns the risk that transplanted patients could be infected by PERV, Pig Endogenous RetroVirus (henceforth referred to as retrovirus) carried by the pigs used for xenotransplantation. As a consequence of this third issue, the human body became part of a network within which both animals and retrovirus were present. The issues are not separated in time; rather they are studied as overlapping activities during the 1990s.

Methods

Two different data categories have been used for the analysis. The first category comprises articles in newspapers and research journals presenting the research. The second category comprises interviews with researchers, politicians and a representative of an animal rights organization, involved in questions concerning xenotransplantation in Sweden in the 1990s. Newspapers and research journals offer an insight into the nature of the discussion at that time. Interviews made it possible for involved interviewees to reconsider and revaluate the central topics that prevailed more than ten years ago. Combining these two sets of data, the analysis in the article presents different perspectives on how the reconfiguration of human and animal bodies developed in the selected period.

Swedish newspapers were collected through search engines on Internet using the search word "xenotransplantation" during the time from 1995 to 2002. Texts dealing with topics central to this article were then selected and analysed. Articles from international journals were collected in those cases where Swedish

8 Bowen 2005; Braidotti 2002; Olesen and Markussen 2003.

newspapers referred to international articles.[9] Fifteen interviews ranging from 40 minutes to 2 hours in length were carried out during 2009 and 2010. The interviewees were medical researchers, researchers in the field of humanities and social sciences working with the medical researchers, politicians and one representative for an animal rights organization. The interviews were tape recorded and transcribed. All the interviews were conducted with a list of questions concerning how xenotransplantation research developed in Sweden in the 1990s.[10] Through the empirical material the main focus has been to explore the discourses on how the relationships between human and animal bodies were challenged in different cultural contexts in the 1990s and early 2000s. These discourses in the material have been analysed by thematizing them into the three different issues referred to above.

Equal, but not too equal

One of the major problems with transplantation of animal organs into human bodies is the compatibility between these two biologically different objects. Researchers have focused on the problem of *immunosuppression*: that the cell, tissue or organ is rejected when adaptation to the new human environment does not succeed due to the efficiency of the immune system. The existence of concrete biological facts regarding the incompatibility between animal and human flesh made it possible to categorize the human as something different from the animal. Many of the earlier xenotransplantation experiments had used kidneys, hearts or livers from nonhuman primates such as baboons or chimpanzees in an attempt to overcome this disparity. But at the beginning of the 1990s, there was a discussion among the medical researchers at Sahlgrenska University Hospital in Gothenburg, concerning the use of nonhuman primates.

In 1995 the researchers at Sahlgrenska University Hospital connected two patients' bloodstreams to pig kidneys as part of a medical trial. The kidneys were placed beside the patients in a box. In the first clinical trial, the human blood streamed through the kidney for one hour and fifteen minutes.[11] Before the trial started, the researchers discussed which donor animal to use. One of the directors of the research team remembers the discussions about using pigs and not nonhuman primates:

> Researcher: *"Considering the number of pigs that we eat, it wasn't so strange to use that animal. However, we felt very strongly that it was impossible to use*

9 This data was presented in an earlier report, see Hansson 2003.

10 The material has been presented in Hansson and Lundin 2011.

11 Hansson 2003.

nonhuman primates. Even though it was likely that it would be easier to use a kidney from a nonhuman primate than from a pig, though I have no evidence of that, we just felt that it was not ethically acceptable. There were several in our group who felt this way. It is difficult when you have human-like structures, so to speak".

Kristofer Hansson: *"You talked about this at the beginning of the project"?*
Researcher: *"Yes, we did. We talked about all sorts of animals. We read a lot about different kinds of animals and concluded that we would work with pigs."*[12]

The medical researcher in the interview refers to the fact that much of the discussion in Sweden at the beginning of the 1990s concerned the origin of the donor animal. This discussion focused upon nonhuman primates being too similar to humans.[13] The earlier donor animals, baboons and chimpanzees, were now seen as having too human-like a structure. In this way, the researchers projected human characteristics onto the nonhuman primates: the baboon and chimpanzee became anthropomorphized.[14] The human characteristic was categorized as closer to what had been distinguished and defined as nature in earlier xenotransplantation experiments. Not only was the relation between the two species discussed, but it also became impossible to use nonhuman primates in medical trials.

During the discussion about the close links between humans and nonhuman primates, the dualism between human and pig was also more clearly identified. As donor animals, pigs were considered a better choice than primates, because they were not too similar to what was categorized as human. As pointed out by the medical researcher, it is an animal that we eat. In this way, there was a ranking between animals, where the nonhuman primates were ranked higher as well as closer to humans. Following the same line of reasoning, pigs were ranked lower. To be able to use the pig in biotechnological research it was important to categorize the animal as something less-than-human and to raise the question of where to allocate the difficult notion of humanness in relation to the various donor animals at hand for the researchers.[15]

Among researchers and in the media, this categorization of pigs was something often discussed from the perspective that pigs were already being reared for meat

12 The interviews were conducted at the researcher's workplace, and a tape recorder was used (Interview: 02.03.2010).

13 Other problems with using nonhuman primates were that they cannot be bred fast enough, and that they are an endangered species.

14 Löfgren 1985.

15 Butler 2004.

Fig. 1. The pig's body was recharged with new and ethically acceptable values that made it possible to use the cells, tissue and organs in the human body. Photo: The author.

production. In the Swedish newspaper *Dagens Nyheter*, a reporter wrote in 1995: "There are few ethical problems working with pigs,"[16] pointing out that since we already use pigs for meat production, there are few ethical problems in using them for medical purposes. While pigs were considered good donors, because their organs are equal in size to human organs and they breed quickly, they were in this way dehumanized.[17] This dehumanization became a way of making it

16 Dagens Nyheter 04.02.1995.

17 Plumwood 1993.

ethically acceptable to use the pig in medical trials, but this dehumanization also came to function as a defence of a certain way of defining humaneness. In identifying the difference between the human body and the cells, tissue and organs from the pig, the unknown became mouldable and manageable and thus the possibility of using the pig as a future organ supply for the human body was created.[18] The pig's body was recharged with new and ethically acceptable values that made it possible to use the cells, tissue and organs in the human body.

The pig as a factory

Even if the human/animal relation became mouldable and manageable by pointing out the differences and similarities between the human, the pig and the non-human primates – transgenic and cloned animals would subsequently change this human/animal relation. Much of the hope for success with xenotransplantation in the 1990s was abandoned in favour of producing transgenic animals, and later cloned animals, in an attempt to get control of immunosuppression. The Cambridge based company Imutran, and the director of research David White, injected human DNA into fertilized sow eggs and a transgenic pig was born in 1992. In 1995, the USA company Nextran also developed transgenic pigs. The Edinburgh based company PPL Therapeutics, who cloned a sheep named Dolly, also cloned the first pigs by the beginning of the year 2000. More companies succeeded in cloning pigs in 2001 and 2002.[19] In order to understand these technological changes from a cultural perspective, it is essential to focus on the dissolution of boundaries between human/animal, as well as between organic/machine. The redefinition of the human and the humaneness can be discussed through the commoditization of the transgenic and cloned animals, a perspective that will be discussed in relation to the anthropologist Sarah Franklin's discussion on how cloning became a genetic capital.[20]

Franklin points out that it is not Dolly the sheep, seen as an animal, that is the source of the genetic capital, but the knowledge of nuclear transfer technology. The knowledge of an animal's reproduction has shifted to the companies that can make a profit. Furthermore, the cloning has altered the commodifying genealogy from a linear to a non-linear relation concerning the animal's reproduction, where its mother can genetically be its sister.[21] The sociologist Richard Twine clarifies this last point when he writes that: "Capitalization speculates for opportunity through the refutation of previously naturalized evolutionary time

18 Åkesson 2000.

19 Brown and Beynon-Jones 2010; Hansson 2003; Persson and Welin 2008.

20 Franklin 2007.

21 Franklin 2007.

and linear genealogy".[22] The capitalization of transgenic and cloned pigs is a way of seeking new patterns for the use of the animal, and the biotechnology companies are striving against something that is not traditional dualism between what is a human body and what is an animal body. This form of capitalization recreates an old metaphor where pigs and other animals are seen as factory farms capable of producing cells, tissue and organs for people who are sick and in need of treatment.[23] The transgenic and the cloned pig are good examples of how the researchers saw this animal as a potential factory farm.

After the first transgenic pig was born in 1992, David White succeeded in producing a second transgenic pig in 1995. This was highlighted in the Swedish tabloid *Aftonbladet*: "The pig is still a pig, it looks like a normal pig. It is only the pig's organs that have become more human-like. The organs fit better in this way in the human body than they did before".[24] A transgenic pig's organs became more flexible and could now fit both pig and human.[25] Through the transformation of the pig's cells, tissue and organs, they now became more like human cells, tissue and organs. The new technique initiated a change of equality between human and animal. This was somewhat opposed to the dehumanization of the pig, which has previously been discussed.

At Lund University a research group planned transplantations of pig cells to patients with Parkinson's disease. Clinical trials were never realized, but the research group conducted animal testing with immature pig cells transplanted into mice and rats, and they also experimented with transplantations from pig to pig. In the beginning, the embryos came from normal pig strains, but the research group had access to some of the transgenic pigs. The director of the research team pointed out in the interview: "The goal was to examine the feasibility of doing this with patients and to understand the mechanisms behind rejection, and to understand the biology. How the nerve cells fit, so to speak".[26] Now, the dualism between the human and the animal body was being challenged on a cellular level, as the project focused on studying how different nerve cells are rejected and how they fit together. Human and pig cells were seen as something similar, and on a cellular level the human and the pig became more comparable. The medical researchers now looked for different technologies and methods to change the dualism between the different objects such as mice, rats, pigs and humans. Animal reproduction alone did not alter the relation between human and animal, but the different techniques and methods of using the animal were also vital for the reconfiguration of bodies. In order to succeed, the researchers needed to fit

22 Twine 2010, p. 101.

23 Fitzgerald 2003; Twine 2010.

24 *Aftonbladet* 09.12.1995.

25 Martin 1994.

26 Interview: 20.10.2009.

human and animal cells together. It was also necessary to dissolve the boundaries separating human and animal.

The company PPL Therapeutics succeeded in cloning a pig on March 5, 2000. The clones were named Christa, (after Christan Barnard who carried out the first human to human heart transplantation in 1967), Alexis and Carrel, (after Alexis Carrel who received the Nobel Prize in 1912 for his transplantation research), and Millie and Dotcom. Millie and Dotcom were symbolic names that related to the economic growth of the Internet companies at the beginning of the new millennium. The names can be seen as a form of popularization where the biotechnological knowledge was translated into something concrete that investors could relate to.[27] However, the cloned pig did not become a success. At the beginning of the year 2000 most countries that had continued with xenotransplantation research, had also introduced a moratorium for clinical and experimental trials on humans. In Sweden the moratorium fragmented the research groups. At the same time stem cell research came as a new and promising biotechnological research that was said to solve the same medical problems as xenotransplantation. By the millennium stem cell researchers had captured the investors' interest.

Dangerous actors

In the middle of the 1990s, new scientific findings emerged, drawing attention to the fact that cells, tissue and organs from animals contain retrovirus that could infect the transplanted patient. They in their turn could infect others and in worst-case scenario, start a global epidemic. In the countries performing or planning medical trials at the time, a moratorium was introduced in anticipation of new regulations. Many countries also started policy processes concerning calling off the moratorium and continuing with clinical trials in xenotransplantation. But when the policy processes had almost concluded by the end of the 1990s and beginning of the 2000s, the interest in xenotransplantation was weak.[28] In Sweden the moratorium came about in 1997 as an agreement among the researchers.[29] As such it led to a difficult time for the Swedish researchers, and no official or publicized transplantations with animal organs have been carried out since the 1990s.[30]

27 Hansson 2005.

28 Brown and Beynon-Jones 2010.

29 Hansson and Lundin 2011.

30 However since the moratorium, there have been xenotransplantations with cells and tissue in different parts of the world (Brown and Beynon-Jones 2010; Persson and Welin 2008).

In 1998, the journal *Nature* had a thematic issue on xenotransplantation, and presented the scientific debate on the risks of the technology. Different researchers' points of view were presented:

> *"Paul Herrling, scientific director of Novartis, says the Hong Kong flu outbreak shows "that the risk from other sources is much greater, and that the added risk in view of the life-saving nature of a successful xenotransplantation might be minimal". Other researchers are less sanguine. "I take the same data and turn it around, saying 'look, this can happen'", says virologist Robin Weiss". […]*
> *"He argues that activation of animal viruses might be favoured under transplant conditions, as these remove many barriers to natural means of infection […] "I'm not saying you shouldn't do this [clinical trials of xenotransplantation], I'm asking you, 'have you stopped to think'?", says Weiss."*[31]

The discussions focused upon the questions whether there was a natural barrier between humans and animals, or if we, as humans, are interlocked in a network within which nature is seen as an intrinsic part, and are therefore exposed to the dangers of virus. Could there be barriers to natural means of infection that would be removed with xenotransplantation? Hong Kong flu, HIV and the connection between BSE (bovine spongiform encephalopathy), also called mad cow disease, and Creutzfeld Jacobs syndrome, were all serious diseases used in the media to show that animals had infected humans. However, in the article above these examples were used by both Herrling and Weiss, and in this way they represented opposite views.

According to the media discussion, the pig became a dangerous object threatening humankind. While the biotechnological researchers tried to control the processes around xenotransplantation, the risk for retrovirus was an unforeseen and uncontrollable consequence for the researchers.[32] With an ANT perspective, as presented in the beginning of the article, it is possible to see how the researchers, as actors, could not fully control other actors such as the retrovirus. The retrovirus is, in the ANT analysis, seen as a nonhuman actor comprising an energy that might affect the outcome of the medical trials in different, and unexpected, ways.[33] In xenotransplantation other nonhuman actors affected the outcome, for example the problem of immunosuppression and cells, tissue or organs behaving in ways the researchers could not fully control. But the retrovirus was unique; it was an actor that contained a greater risk, as it was also able to infect a third party.

31 *Nature* 22.01.1998, p. 321.

32 Twine 2010.

33 Goodman 2001.

The ANT perspective highlights how research and patients' bodies are only part of a wider network of other actors. In this perspective the relationship between human and animal bodies is once again questioned. One of the directors in the research team in Gothenburg explains how he changed his views, and started to see retrovirus as something that the researchers could not completely control, a perspective that a medical ethicist had pointed out to him:

> *"[The medical ethicist] had this thesis that we must consider retroviral epidemic as a plausible result. So we had to try to find ways of preventing or minimizing this. I think I also got into that line of reasoning very early. I can't remember who came up with the idea first, but it just isn't possible that the risk is so small that it is non-existent."*[34]

The bodies and organs can be seen as what Lynda Birke, researcher in feminist science studies, calls "black boxes". The medical researchers can view these black boxes in terms of input or output, but what happens inside the box remains hidden from their view.[35] The researcher cannot predict or know all the consequences of what he or she is doing. Using this concept in relation to the xenotransplantation case is however not equivalent to a perception of the human or the animal body as a closed system uncontrolled by the researchers. Rather, the term black box emphasizes that researchers cannot have insight into all areas of biology, and in parallel, biology can influence the development of the network in different and unpredictable ways. The risk for retrovirus can be seen as a knowledge that once again reconfigures the human body, and not as a rational and predictable object, but more like an irrational animal.[36]

Boundless bodies

In an interview, the sociologist Nicholas Gane and the philosopher Donna Haraway paraphrase the sociologist Bruno Latour's "we have never been modern"[37], when they point out that "we have never been human".[38] Taking xenotransplantation as an example, this kind of biotechnological research seems to bring the argument further. The use of cells, tissue and organs from pigs in medical trials and experiments in laboratories, call into question the boundaries between these species. Being objects in flexible systems, both the human body and the pig's body

34 Interview: 02.03.2010.

35 Birke 1999.

36 Gane and Haraway 2006, Murray 2006.

37 Latour 1993.

38 Gane and Haraway 2006.

are doomed to be reconfigured. However, the patients that have gone through xenotransplantations strive to overcome the boundlessness that they experience. This was noticed by the ethnologist Susanne Lundin while interviewing patients with diabetes, who in the beginning of the 1990s received transplants of pancreatic islets from pigs, she describes how these patients strived to find manageable definitions after being transplanted:

> *"It is clear that my informants are searching for manageable definitions of what is foreign and what is their own. They share a will to find principles for how to handle matter from a foreign species. In this context, the body is a central point. For when biotechnology makes it possible to transgress and even erase fixed boundaries, between different bodies and life forms, a need arises to place oneself in a meaning-creating system. As we have seen, this applies to donations and transplants in general, but it is seen with particular clarity in the case of xenotransplants."*[39]

However for biotechnological development, the reconfiguring of the human and animal bodies, and thus also the changing relationship between these two bodies, was central to the creative processes of discovering new treatments. Such a perspective opens up different aspects. The boundlessness between bodies and objects is the desirable approach, a place where the pig's body can be objectified in new ways and the researchers and the biotechnology companies can create biomedicine that can be commoditized. For the medical researchers it is central to challenge the traditional dualism between human and animal. The meaning-creating system for the medical researchers is, in contrast to the patient, the boundless body.

The reconfiguration of objects is an important part of how biotechnological research constantly creates new objects. It is something other than the patients searching for manageable definitions of what is foreign; instead it is the foreign that is of interest.[40] As the sociologist Bryan S. Turner points out: "Technology appropriates nature by alienation: that is by reconstituting it as an object. But in the alienation of nature, 'Man' opens up the possibility of working on the body, of transforming human ontology".[41] It is vital to point out the variance in patient's views of how to handle this boundlessness. It is also important to discuss which networks make it possible for biotechnological research to strive for a reconfiguring of the body.

39 Lundin 1999, p. 20–21.

40 Lundin 1999.

41 Turner 2007, p. 23.

Concluding thoughts

Animals perceived as biotechnological matter are in many different ways challenging the relationship between human and animal. The xenotransplantation research in the 1990s is only one example, but one that gives us many different perspectives on how to understand the challenges faced by dualism. Three issues have been pointed out in the article: the use of pigs in xenotransplantation, transgenic and cloned pigs, and the risk for retrovirus. Vital for the two first issues is a research and commodification process, where the reconfiguration of the animal body is made possible by using the bodily objects as cells, tissue and organ donors. The pig as biotechnological matter reconfigures both the human and the animal body, and it seems that a more boundless body appears among the researchers and biotechnological companies. Creative possibilities can be found in this boundless body as well, and new medical treatments can emerge. The third issue relates to a boundless body, but in contrast to the promising prospects of supplies for medical treatment the transgressive body would now become a threat. In the 1990s the researchers could not control the retrovirus and this risk hindered the development of xenotransplantation. Analysing the process from three different perspectives, it is central to see how the reconfiguration of objects is an on-going cultural process that questions our perspectives on what is ontologically a human/animal body. This biological process is not entirely social in its nature, but also cultural. When the biological entities are questioned and actually transformed, new body objects emerge.

* The author would like to thank the reviewer for the comments that helped to improve the manuscript. Thanks also to Anne Leonora Blaakilde, Aske Juul Lassen, Monica Libell, Niclas Hagen, Åsa Alftberg, Andrea Landström and Teresa Landström for insightful comments on previous manuscripts.

References

Aftonbladet 09.12.1995: "Grisen ska ge dig längre liv" [Transl: The pig will give you longer life]. Article by Lotta Reberg.

Berg, Marc & Stefan Timmermans, 2000: "Orders and Their Others: On the Constitution of Universalities in Medical Work". *Configurations*, Vol 8:1, p. 31-61.

Birke, Lynda 1999: *Feminism and the Biological Body*. Edinburgh University Press.

Bowen, Leslie Maria 2005: "Reconfigured bodies: the problem of ownership". *Communication Theory*, Vol 15:1, p. 23-38.

Butler, Judith 2004: *Precarious Life. The Powers of Mourning and Violence*.

Braidotti, Rosi 2002: *Metamorphoses. Towards a materialist theory of becoming*. Polity Press.

Brown, Nik & Siân Beynon-Jones (eds.) 2010: *CIT-PART Deliverable 3 Overview on XTP policies and related TA/PTA procedures*. Available at <http://www.cit-part.at/Deliverable3_final.pdf>, last accessed 25/08/2011.

Dagens Nyheter 04.02.1995: "Njursjuk använde grisnjure. Lyckat försök I Göteborg kan öppna väg för transplantationer" [Transl: Person with kidney disease used pig kidney. Successful trial in Gothenburg can open the door for transplants]. *Article by Peter Sandberg.*

Deschamps, Jack-Yves, Françoise A. Roux, Pierre Saï & Edouard Gouin 2005: "History of xenotransplantation". *Xenotransplantation*, vol. 12:2, p. 91-109.

Fitzgerald, Deborah 2003*: Every Farm a Factory. The Industrial Ideal in American Agriculture*. Yale University Press.

Fox, Marie 2005: "Reconfiguring the animal/human boundary. The impact of xeno technologies". *Liverpool Law Review*, vol. 26: 2, p. 149-167.

Franklin, Sarah 2007: *Dolly Mixtures. The Remaking of Genealogy.* Duke University Press.

Gane, Nicholas & Donna Haraway: "When We Have Never Been Human, What Is to Be Done". Interview with Donna Haraway. *Theory, Culture & Society*, vol. 23: 7-8, p. 135-158.

Gilbert, Jeremy 2008: *Anticapitalism and Culture. Radical Theory and Popular Politics*. Berg Publishers.

Goodman, David 2001: "Ontology Matters. The Relational Materiality of Nature and Agro-Food Studies". *Sociologia Ruralis*, vol. 41:2, p. 182-200.

Hansson, Kristofer 2003: "Djur som donatorer. Xenotransplantation i svenska medier 1995-2002" [Transl: Animals as donors. Xenotransplantation in Swedish Media 1995-2002]. *Lundalinjer*, nr. 120.

Hansson, Kristofer 2005: "Biopop. Biovetenskapens popularisering i medierna" [Transl: Biopop. The popularization of biomedicin in the media]. *ETN. Etnologisk skriftserie*, nr. 1, p. 107-117. Available at <http://www.kultur.lu.se/upload/Kulturvetenskaper/etn1.pdf>, last accessed 25/08/2011.

Hansson, Kristofer & Susanne Lundin 2011: *The Swedish Case*, "Impact of Citizen Participation on Decision-Making in a Knowledge Intensive Policy Field" (CIT-PART). Available at <http://www.cit-part.at/CIT-PART%20Deliverable%2011_12.pdf>, last accessed 03/11/2011.

Lanza, Robert P. & David K.C. Cooper 1998: "Xenotransplantation of cells and tissues: application to a range of diseases, from diabetes to Alzheimer's." *Molecular Medicine Today*, Vol. 4:1, p. 39-45.

Latour, Bruno 1992: "Technology is society made durable". John Law (eds.): *A sociology of monsters: Essays on power, technology and domination*.

Latour, Bruno 1993: *We Have Never Been Modern*. Harvard University Press.

Lederer, Susan E. 2008: *Flesh and Blood. Organ Transplantation and Blood Transfusion in Twentieth-Century America*. Oxford University Press.

Lundin, Susanne 1999: "The boundless body. Cultural perspectives on xenotransplantation". *Ethnos. Journal of Anthropology*, vol. 64:1, p. 5-31.

Löfgren, Orvar 1985: "Our friends in nature: Class and animal symbolism". *Ethnos. Journal of Anthropology*, vol. 50: 3-4, p. 184-213.

Martin, Emily 1994: *Flexible Bodies. The Role of Immunity in American Culture from the Days of Polio to the Age of AIDS.* Bacon Press.

McLean, Sheila A.M. & Laura Williamson 2005: *Xenotransplantation. Law and* Ethics. Ashgate Publishing Limited.

Murray, Mary 2006: "Lazarus [1], liminality, and animality: Xenotransplantation, zoonosis, and the space and place of humans and animals in late modern society". *Mortality*, vol. 11: 1, p. 45-56.

Nature 22.01.1998: "Last chance to stop and think on risks of xenotransplants", vol. 391 (6665), p. 320-324. Article by Declan Butler.

Olesen, Finn & Randi Markussen 2003: "Reconfigured Medication: Writing Medicine in a Sociotechnical Practice". *Configurations*, vol. 11: 3, p. 351-381.

Persson, Anders & Stellan Welin 2008: *Contested technologies. Xenotransplantation and human embryonic stem cells.* Nordic Academic Press.

Plumwood, Val 1993: *Feminism and the Mastery of Nature.* Routledge.

SOU 1999:120. *Från en art till en annan. Transplantation från djur till människa. Betänkande av xenotransplantationskommittén*. [Transl: From one species to another. Transplants from animals to humans. Report of the xenotransplantation committee]. Stockholm: Regeringskansliet.

Turner, Bryan S. 2007: "Culture, technologies and bodies: the technological Utopia of living forever". *The Sociological Review*, vol. 55: Supp/1, p. 19-36.

Twine, Richard 2010: *Animals As Biotechnology. Ethics, Sustainability and Critical Animal Studies*. Earthscan Ltd.

Åkesson, Lynn 2000: "Blodsband som förenar och förskräcker. Släktbegreppens komplikationer" [Transl: Blood ties that unite and frighten. The complications of family concepts]. Susanne Lundin & Lynn Åkesson (eds.): *Arvets Kultur. Essäer om Genetik och Samhälle* [Transl: Culture of heritage. Essays on Genetics and Society]. Nordic Academic Press.