

**Body Commodification and Kidney Xenotransplantation**

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**On my honor as a University Student, I have neither given nor received unauthorized aid  
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments**

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## **Background**

Currently the most promising form of solid organ xenotransplantation is heart and kidney xenotransplantation. Pig-to-nonhuman primate models of heart xenotransplantation have supported life for more than 6 months and pig-to-nonhuman primate models of kidney xenotransplantation supporting life for more than a year. For this reason clinical trials of xenotransplantation of these solid organs are now being planned. Furthermore, trials of kidney xenotransplantation are suggested by many scientists within the field to become the first clinical trial, due to the fact that a kidney could be removed in the case where an organ is rejected and a heart could not be. Given that the prospect of taking xenotransplantation from the lab to the clinic has been a goal for over a century, I aim to review the current literature regarding plans for clinical kidney xenotransplantation. A 2021 review article was published by world renowned xenotransplantation researcher, David K.C. Cooper, and his team aimed to detail the steps that need to be taken to prepare for the first clinical trials of pig kidney xenotransplantation (Cooper et al., 2021).

In 1963 Reemtsma et al. transplanted chimpanzee kidneys into six patients which all but one suffered from infection or organ rejection within eight weeks. The NHP (non-human primate) kidney was able to support this man for 9 months before he passed away. In the 1980s physicians and researchers realized that pigs were more advantageous as a source of organs than NHPs. However the initial experiments of pig-to-NHP xenotransplantation were unsuccessful resulting in immediate graft rejection referred to as hyperacute rejection. It is important to note that these initial experiments used wildtype pigs, that is pigs without any genetic modifications. Researchers had a greater respect for the immunological differences between species that have evolved over time and the challenge they present in regard to successful xenotransplantation.

Despite being faced with the challenges of immunological barriers, xenotransplantation offers the opportunity to modify the characteristics of donor organs rather than being limited to treating the recipient as is the case in allotransplantation. In the 1990's the first attempts at modifying the donor pigs to achieve increased graft survival were focused on introducing human complement-regulatory protein into the pigs via genetic mutations (Dalmasso et al., 1991). With pigs expressing this protein the immune response of NHPs would be prevented and in subsequent experiments graft survival was extended. Along with this addition of human transgenes into the pig genome, the discovery of the pig xenoantigen (Gal) and its involvement in graft rejection in NHPs and humans was crucial to extending graft function (Good et al., 1992). Humans and NHPs naturally react with this pig xenoantigen thus researchers were able to breed pigs in which the gene producing this antigen is deleted (GTKO) (Kolber-Simonds et al., 2004). In 2015 the use of GTKO pigs in combination with the expression of human complement-regulatory protein greatly reduced the early graft rejection in NHPs (Azimzadeh et al., 2015). Research and experiments focusing on genetic engineering of pigs used the previous two strategies to achieve a more suitable donor source of organs. The two strategies that have been used for genetic engineering are deletion of pig xenoantigens and insertion of protective human transgenes. Recent advances in the field of genetic engineering such as CRISPR/Cas9 has greatly reduced the time, effort, and cost required to produce a genetically modified pig. With increased knowledge of immunobiology and novel genetic engineering techniques companies began to produce and breed pigs with specified genomes. Now with a plethora of pig strains to utilize, scientists and researchers argue that preclinical data from NHP models of kidney xenotransplantation have sufficiently warranted the initiation of clinical trials in humans.

Literature recently published by experts in this field of research proposes plans for the first clinical trials and the selection of patients for these trials.

## **Literature Review**

Disparities in organ allocation for allotransplantation have been identified and studied within the United States and the global south where resources are especially scarce. Over many decades now researchers have shown that even when medical differences are accounted for (eg., diabetes, obesity) racial and ethnic minorities in kidney transplants are evident. Although allotransplantation is the established treatment for end stage kidney disease equitable access is still not a reality, especially if the uninsured population is accounted for (as they should be). The goal of xenotransplantation and the justification for its development is the end goal of achieving an unlimited supply of transplantable organs. Xenotransplantation has been offered as a solution to not only solve the need for transplantable organs but also as a means to circumvent disparities encountered in allotransplantation. This is due to the fact that xenotransplantation does not rely on humans to donate organs but rather organs are produced as a commodity. For this reason I will review the recent research focusing on injustices and inequalities within the practice of kidney transplantation in order to evaluate how such disparities may translate to the practice of clinical kidney xenotransplantation.

The 1984 National Organ Transplant Act (NOTA) established a system for organ allocation with the defined intent to eliminate inequities in the distribution of whole organs. This system, the Organ Procurement and Transplantation network, operates under federal agencies and contracts the United Network for Organ Sharing (UNOS) to facilitate operations between organ procurement organizations and transplant centers. Due to the scarcity of organs, the UNOS created a formula to match patients onto available organs in the most ethical and equitable

manner. Using computerized national databases these formulas match patients to organs based on factors such as blood type, histocompatibility, waiting time, logistics, and medical urgency.

When new organs become available this formula generates a list of patients stratified by priority to that specific organ. For patients already on the waitlist for an organ the ability to pay for that organ is not considered in the allocation formula, however the ability to pay often affects one's chance of initially being placed on the waitlist.

Kidney transplantation is the most effective therapy for chronic kidney disease which develops in patients with Early Stage Renal Disease (ESRD) and disease such as diabetes which both disproportionately affect African Americans. A plethora of potential barriers to kidney transplantation have been suggested such as genetics, physicians bias, patient education, and social determinants. Regardless of the cause, in the US African American kidney transplantation is not consistent with this group's burden of disease as shown by Patzer. This study examined the relationship of geographic distance to a transplant center to African Americans' likelihood of being put on a kidney waiting list and receiving a kidney transplant (Patzer et al., 2009). Many studies similar to this one aim to elucidate the factors that contribute to the racial disparities that persist in the US kidney transplantation process. Particularly one aspect that has been studied is the aspect of patients being placed on a waiting list as it is a step that is dependent largely on the subjectivity and personal values of the decision-making physician.

### **Conceptual Framework**

Nancy Scheper-Hughes and Margaret Lock's notion of "the body politic" has been previously leveraged to address inequalities and injustices associated with the practice of transplantation which I aim to extend to the emerging practice of xenotransplantation (Scheper-Hughes & Lock, 1987). Donna Haraway's Cyborg Manifesto calls upon the modern

cyborgs, who are the users of novel developing technologies which they should shape politically by arbitrating their cultural meaning and uses. For numerous reasons kidney allotransplantation has historically been unjust in the US and globally, thus it is imperative to evaluate if clinical kidney xenotransplantation will be a more just alternative. Additionally I draw upon Haraway's metaphorical descriptions of the immune system as a cybernetic organism and Joralemon's 1995 analogy of rejection to evaluate the body(cyborg) politics of both allo transplantation and xenotransplantation. Using Haraway's posthuman writings to establish clinical kidney xenotransplantation as the commodification of the cyborg-body. I will argue that the cyborg as a commodity creates new relations of power and control not present within the existing clinical kidney allotransplantation. I argue that clinical kidney xenotransplantation threatens to do harm to already marginalized populations. Examining clinical kidney xenotransplantation from a sociocultural perspective allows for an improved understanding of how the practice is rooted in existing cultural norms.

## **Analysis**

### *Body Politics of Transplantation*

Medical anthropologists have previously discussed and displayed concern over the body commodification and objectification that occurs within the organ transplantation process (Scheper-Hughes & Wacquant, 2002). This literature elucidates that attempts to increase the limited supply of organs take one of two approaches. The 'gift' giving (altruism) approach or individual rights and open market. Transplant professionals such as physicians, nurses, and caregivers frame the transplanted organ as a 'gift' of altruism in order to objectify the organ from any characteristics of its donor. However Sharpe has previously noted that this altruistic ideology veils the inherent commodification of the body that takes place throughout the transplant

process (Sharp, 1995). Scheper-Hughes has shown that body commodification in transplantation has and continues to occur in a very literal sense by providing examples of how organs are bought, sold, and even stolen. Thus objectification of the body in transplantation may be unavoidable, however the 'gift' narrative utilized by transplant professionals is an attempt to subvert from the true objectification of the body through commodification. Nevertheless, the practice of transplantation and its associated networks are tied to a reality or world in which body objectification through commodification is a cultural norm.

### *Immunological Objectification*

Donald Joralemons 1995 was previously mentioned for its discussions of the ideologies of 'gift' giving and individual rights. More specifically Joralemons claims that both these ideologies of objectification 'suppress' the notions and norms of the body and self rather than replacing them (Joralemon, 1995). This is then compared to the way in which immunosuppressants attempt to suppress infection from foreign invaders but can never eradicate the possibility of rejection. The biological analogy suggests that analyzing the practice of transplantation and xenotransplantation will offer profound insight into the social world. The immune system, among other biological systems, has commonly been used as a metaphorical aid in describing the social world associated with numerous things namely biotechnologies (Haraway, 1985). Haraway explains that development of cybernetic systems following WWII was accompanied by increased research and scientific knowledge of the immune system in effort to control an inherently natural system and gain biological power. In part of the wider scientific movement to understand and manipulate the natural world, genetic engineering and immunology have increasingly enabled us to manipulate the immune system. Haraway describes how the

immune system is a process of reading and writing cryptographic messages which decode in an attempt to understand and control nature.

The ability to manipulate the immune system greatly contributed to the widespread use of kidney transplants through the development of immunosuppressants like cyclosporine (Cohen, 2001). Here the immune system is exploited to blur the categories of what is and is not one's 'self' or 'body', but in other cases knowledge of immunology results in distinctions or categorizations of what is self and what is other. This is the case with HLA matching protocols on kidney transplantation. The amount and type Human Leukocyte Antigens (HLA Phenotype) differ in ethnic and minority populations and are used with organ allocation formulas to ensure similarity between the donor and recipient bodies. The Utilitarian justification for the use of this immunological classification system is to find the most appropriate match to make the most use out of the donated kidney. Regardless of ethical justification this biological categorization discriminates against minorities as there are less matching kidneys. The same knowledge of and control over the immune system as a coded and manipulable text allowed for an expansion of the supply of possible transplantable kidneys through immunosuppressants that work to blur the boundaries of 'self' and 'other'. The blurring of boundaries suggests a biological plasticity that is not consistent with the biological categorizations stemming from the knowledge over the immune system. Thus the politics of the immune system are the politics of the body which is rooted in the fluid battle between 'self' and 'other'.

### *Cyborgs of Transplantation*

The cyborg, defined as the combination of human, animal, and technological components, is a symbol for reimagined possibilities that can be either productive or destructive and inclusive or exclusive. Much work from sociology scholars have focused on studying the



cyborg within medicine and other fields. Hospitals commonly harbor cyborgs and an obvious example are brain-dead patients being kept alive by respirators and other machines. Other medical technologies that have been used in the creation of cyborgs include prosthetic limbs, artificial joints, pacemakers, and heart valves. These technologies redefine what 'nature' means through creating a modern cyborg which can garner a wide variety of cultural responses. The cyborg challenges what it means to be human which may align the ideals and culture of certain groups more than others. The advent of allotransplantation as well as xenotransplantation both create modern day cyborgs in their own respects. Mainly allotransplantation blurs the boundary of individual human bodies, thus questioning the notion of personal human identity. While xenotransplantation blurs the boundary between human and animal, challenging what it means to be human. Harraway's work is important in this regard as she has extensively studied the networks associated with "the reinvention of nature". Clinical kidney allotransplantation and Xenotransplantation each create different relationships between organisms and technology that each determine the qualities of the cyborg respectively. HLA matching protocols and improved immunosuppressant drugs both are produced from an increased knowledge and thus control over the immune system and more generally nature. These artifacts are derived from the manner in which we define and describe what is natural and what is not in regard to the immune system. These biotechnologies are what creates the cyborg body within transplantation and its associated politics. HLA typing and immunosuppressant drugs aim to increase efficacy and accessibility of transplantation for all, but ultimately harm previously marginalized groups. There are less kidneys for minorities due to HLA matching protocols. Immunosuppressants have increased the supply of transplantable kidneys through disabling the body's ability to distinguish between self and other at the molecular level. This biomedical innovation expanded the pool of possible

kidney donors but also expanded the reach and power of the kidney transplantation complex as stable chains of supply and demand have been established that prioritizes certain groups and bodies over others.

Understanding the practice of transplantation in terms of its body and cyborg politics allows for a better understanding of how the practice of xenotransplantation is rooted in existing cultural norms that cultivate the politics of this biotechnology. In transplantation immunitary boundaries between self and other at the molecular and body level have been blurred by increased control over nature facilitated by knowledge and achievements within biomedical domains. Specifically in kidney transplantation the ability to distinguish between self and other allowed for more successful transplantation via HLA matching systems. The ability to recognize self and other subsequently via immunosuppressant drugs allowed for these boundaries to be blurred and larger pool of possible transplantable kidneys. Both of these innovations allowed for more successful kidney transplantation in some aspects, but also marginalized previously affected groups. The markers used to distinguish self from other and drugs used to suppress this achieve a hybridity between two previously foreign human kidneys. The creation of cyborgs in regard to kidney transplantation in this manner mediated the techno-scientific production has allowed for liberating opportunities for patients and doctors while oppressing others.

The cyborg produced in xenotransplantation differs in that the boundary that is attempting to be blurred is between human and other. The transplantation boundary between humans once seemed impermeable to doctors. Xenotransplantation researchers genetically engineer pig organs to be more similar to humans as previously discussed. The improvements in genetic engineering and knowledge of human-pig immune difference has contributed to the development of pig-to-human transplantable kidneys. Increased knowledge and thus control over

natural systems creates a new and distinct cyborg and associated politics. The new hybridity and cyborg developed from the practice of kidney xenotransplantation has the potential to liberate or suppress groups previously marginalized by the practice of kidney allotransplantation as discussed earlier.

## **Conclusion**

Despite the social security act of 1974 providing access to kidney transplants, inequalities and injustices within this practice presently persist. The production of knowledge in deciphering the coded text of the immune system began following WWII and contributed to the success and widespread clinical use of Kidney transplantation. Techno-scientific knowledge production focused on the immune system established markers to identify self from other as to improve the success rate of kidney transplantation. The implications of this knowledge resulted in fewer kidney transplants for minority groups. Additionally the ability to suppress this immune response through immunosuppressive drugs allowed for commodification of bodies and global supply and demand chains of transplantable kidneys. The practice of kidney transplantation blurred boundaries creating a cyborg that is politicized and commodified. Kidney xenotransplantation creates a different cyborg in that pigs are used as an organ source, which changes the boundaries which are attempting to be blurred by researchers. The cyborg of kidney xenotransplantation differs from that of allotransplantation not only in regard to the immunological and identity boundaries but also in terms of politics and commodification. Xenotransplantation is a derivative of the transplantation network thus the norms established in these practices are likely to be translated from one to the other. Kidney transplantation and allocation systems are covered with uncertainty regarding fairness and equity. It is unknown whether kidney xenotransplantation will be accompanied by similar inequities and injustices that are pervasive within the kidney

transplant system, however disparities should be analyzed further as kidney xenotransplantation becomes a clinical practice as to determine which groups are may be marginalized by this biomedical innovation. Examining the prospect of clinical kidney xenotransplantation through Haraway's vision of the cyborg is crucial to acknowledging potential oppressive features while taking control and exploiting the liberating possibilities of this biomedical innovation for as many individuals and groups as possible.

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