



To Share or not to Share? Institutional Exchange of Cadaver Kidneys in Denmark

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Kidney transplantations are about exchanges. Grafts are moved from dead bodies to living ones in return for gratitude and meaning; between friends and family members out of, or in hope of, affection; and between strangers for philanthropic or pecuniary reasons.¹ These exchanges raise legal, psychological, ethical, and philosophical questions, and kidney transplantations owe their high visibility as much to the ongoing debates about these issues as to their therapeutic qualities. Consequently, exchanges like these have received much attention from scholars, stressing how kidney transplantations, along with other kinds of organ transplantations, involve society in a unique way. Renée Fox and Judith Swazey, pioneers in the sociological study of kidney transplantations, asserted in 1978 that the importance of renal replacement therapies “lies as much in their social and cultural significance as in their medical and surgical value”, thus announcing a broad perspective on the significance of kidney transplantations that continues to dominate non-medical research in the field to this day.²

But kidney transplantations also involve exchanges on a different level. Jeffrey Prottas reminds us that “before they go to patients, organs go to transplant teams and hospitals”.³ Doctors and transplant centres involved at this level hold strong vested interests in how organs are distributed, and exchanges at the institutional level are thus potentially as problematic as exchanges on a broader societal level. Prottas identifies two different ways of allocating organs for transplantation. In the first case, organs are distributed according to general criteria accepted by a group of transplant centres and are offered to the most suitable recipient within the network of cooperating centres. In such a system, clinicians in local hospitals have little formal influence on the allocation of grafts, and authority lies primarily with regional or national organ allocation agencies. In the second case, organs are distributed according to criteria set up by individual transplant centres. Such a system does not preclude the sharing of organs between different hospitals, but, since decisions about allocation are primarily made by local clinicians, there will be a tendency to offer grafts to local patients.⁴ Just as public and political feelings about the exchange of organs vary a great deal culturally and historically, medical attitudes towards kidney allocation at an institutional level have shifted over time, and both ways of allocating organs can be identified in the history of kidney transplantation.

In this article, I shall look at the history of institutional kidney allocation in Denmark, and more precisely at the background of some important changes that took place in the 1980s.⁵ The first kidney transplantation in Denmark was carried out in 1964.⁶ In 1969, Danish doctors were central in the establishment of Scandiatransplant, a kidney allocation organization serving the Nordic countries. Transplant centres committed themselves to offering the kidneys they might procure to the most suitable recipient in the region, with tissue type match being the most important allocation criterion. With four transplant centres and the

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- Contents
- Archive

Related material:
PubMed related arts
GO

PubMed articles by:
BAK-JENSEN, S.

- Top
- Why did Regional Kidney Exchange Decrease?
- Regional Kidney Exchange
- The Politics of Tissue Typing
- The Alternative of Local Use
- A Struggle between Perspectives and Specialisms
- Cyclosporine and the Legitimacy of Local Priorities
- Conclusion

world's highest transplantation rate for most of the 1970s, Denmark was the main receiver of kidneys in Scandiatransplant, and Danish transplant centres relied heavily on the cooperation with other Nordic centres.⁷ In 1971, almost 75 per cent of all donor kidneys in this region were exchanged from one hospital to another through Scandiatransplant, and the exchange rate fluctuated around 50 per cent for the next decade. In the early 1980s, this kind of cooperation and the reliance upon histocompatibility came under pressure as more organs were used in the centre where they were procured. Only 15 per cent of all kidneys were exchanged between transplant centres in 1985, and that has remained the average.⁸ Scandiatransplant performed a series of revisions of exchange criteria, all pointing towards a decrease in regional kidney exchange. Kidney transplantation in Denmark thus went from being regional to being predominantly local in scope.

The Danish case has many similarities with developments in other countries in western Europe, which also generally went through a shift from a regional to a local, or from an inter-institutional to an intra-institutional, outlook in kidney exchange.⁹ During the 1970s, most European transplant centres participated in regional kidney exchange organizations such as Eurotransplant, established in 1967, which served as a model for Scandiatransplant and was soon followed by organizations like France-Transplant and UK Transplant.¹⁰ In the 1980s exchange criteria were revised and loosened, and the kidney exchange organizations came to occupy a more marginal role in the allocation of organs.¹¹ The history of institutional kidney allocation in Denmark might thus serve as a case study for developments in Europe more generally. Such a comparative perspective is beyond the scope of this article, but I will continually point out how the Danish case relates to more general developments, both in order to encourage a comparative study of historical practices of organ allocation in different countries, and because events in Denmark were closely connected to and influenced by international discussions.

The Danish history may also, however, display particularities that cannot be found elsewhere. Geographically, Denmark is a small country with a well-developed infrastructure, and thus suited for nationwide transportation of organs. Politically, the provision of health care services on the basis of equal access is seen as a central task for the national government. This is true for most European countries, but the Danish and other Scandinavian populations have demanded more wide-reaching public control over the workings of the health care system. Michael Bos argues that, in Europe, kidney transplantations were generally introduced and organized with little involvement from health authorities.¹² Yet the Danish state took an early and strong interest in the regulation and planning of kidney replacement therapies and was able to influence developments through control of financial means. New technologies were thus introduced in an environment of stronger central control than was the case elsewhere. Also, the change from regional to local allocation of kidneys has been more remarkable in Denmark than in central or western European countries. The criteria of histocompatibility for kidney allocation was embraced strongly in the Nordic countries in the 1970s. Yet today, Scandiatransplant is one of the organ exchange organizations that has gone furthest towards abandoning tissue typing as an exchange criterion, and Danish transplant centres now enjoy a high degree of freedom in how they chose to allocate kidneys.¹³ It is not my purpose here to account for how these particularities may have resulted in a special way of organizing kidney transplantations in Denmark. I mention them in order to emphasize the limits of the analysis I present, and to stress how comparative studies may enrich our knowledge of the history of kidney sharing.

[Top](#)

■ [Why did Regional Kidney Exchange Decrease?](#)

[Regional Kidney Exchange](#)

[The Politics of Tissue Typing](#)

Why did Regional Kidney Exchange Decrease?

Developments in kidney exchange in Scandiatransplant, and indeed in any other European kidney exchange organization, have not so far been the subject of detailed historical analysis. Overviews of the historical background of kidney exchange in the Nordic countries can be found in presentations by doctors involved in Scandiatransplant, and they generally point to the advent of cyclosporine, a new immunosuppressant drug introduced in the early 1980s, as the reason for the drop in exchange rates.¹⁴ Cyclosporine proved more

effective in preventing acute graft rejection than previous immunosuppressive regimes, thus making kidney transplantations much safer. Just as importantly, cyclosporine assured prolonged graft survival even in cases of poor tissue type match, thus allowing not only renal transplantations but also other kinds of whole-organ replacements to be carried out on a larger scale. Developments in immunosuppression are also seen as central in the international literature on the history of kidney transplantation, where cyclosporine is often perceived as introducing a new era, the “Cyclosporine Era”, in which organ transplantation came of age.¹⁵ The introduction of cyclosporine and the diminished importance of histocompatibility in organ allocation is also seen to have undermined the rationality of tissue typing and thus led to a drop in regional kidney exchange and a more marginal role for organizations like Scandiatransplant.¹⁶

A few studies have tried to move beyond this pharmacological determinism by pointing to how preferences for regional organ exchange on the basis of histocompatibility testing was influenced by more general socio-cultural factors. Ilana Löwy argues that while institutional organ exchange was broadly accepted by European transplant teams, American counterparts were generally sceptical, with controversy over the value of histocompatibility testing raging across the Atlantic for most of the 1970s. Since no conclusive statistical evidence regarding the clinical value of tissue typing was presented during this period, Löwy suggests that the importance of equality in western European approaches to public health care provision and the existence of centralized health care systems made regional organ exchange through organizations like Eurotransplant and Scandiatransplant “quasi-natural” in this part of the world.¹⁷ This view is supported by Anne-Marie Moulin, who also points to how the more decentralized health care system in the USA gave rise to greater local variation in the organization of kidney transplantations.¹⁸

The analyses by Löwy and Moulin point towards more recent studies on the nature of medical innovations, for example cyclosporine, and their relation to changes in medicine. These studies treat innovations as historically contingent and see the successful diffusion (or lack thereof) of new ideas or technologies as influenced by social and cultural forces, and not as a product of inherent and objective qualities of specific ways of handling or thinking about health and disease.¹⁹ A whole range of relevant contexts for the understanding of medical innovations have been suggested, with many researchers indicating how general cultural values or social characteristics play a central role in the evaluation of progress and innovation in health care.²⁰

The perspective of how overall political and cultural attitudes inform the distribution of donor organs is an important one, and one that has received increasing attention.²¹ But it is also clear that the perspective of general norms and values, as employed by Löwy and Moulin in their studies of European kidney exchange, presents problems if we wish to explain developments in this area. The focus on fundamental attitudes towards health care provision makes it difficult for Moulin and Löwy to understand the dynamics behind the changes that occurred in the organization of European kidney transplantations in the 1980s. By referring to values supposedly common to western European countries, Löwy and Moulin homogenize the attitudes of transplant teams. This does not correspond with the information also supplied in their studies that differences did actually exist between European transplant centres and, more importantly, that attitudes towards regional kidney exchange varied between different kinds of doctors. Historical accounts by medical doctors involved in kidney transplants in the 1970s will usually stress a conflict between immunologists and clinicians over the value of histocompatibility testing and hence the rationality of regional kidney exchange. According to Jean Dausset, one of the pioneers of histocompatibility testing and the founder of France-Transplant, the scepticism of surgeons was one of the major obstacles to regional kidney exchange.²² This conflict between specialisms is noted by Löwy and Moulin, but they do not discuss the way in which disagreements at this level may qualify the view that more general, “non-scientific” socio-cultural factors determined the attitudes of transplant teams.²³ Also, since basic attitudes towards access to health care services did not undergo changes that can be related to changes in attitudes towards kidney allocation, cyclosporine acquires a determining role in their analyses. According to Moulin, “cyclosporine made the search for compatibility at any cost a thing of the past” and thus changed the whole problematic of kidney transplantations.²⁴ And

Löwy, writing just when the changes were happening, speculated that a generalized use of cyclosporine would create a demand for new criteria of kidney allocation and that transplant centres might “liberate themselves from the constraints characteristic of centralized organ distribution”.²⁵

In what follows, I wish to moderate the view that changes in institutional kidney exchange were influenced primarily by innovations in immunosuppression and by general socio-cultural values, by applying a third analytical perspective to the analysis of kidney exchange in Denmark. My contention is that even though the rationality of regional kidney exchange was dominant during the 1970s and Danish transplant centres were operating within an immunological conceptualization of kidney transplantations through their involvement in Scandiatriplant, other ways of thinking about and practising kidney allocation existed. Many clinicians, mainly surgeons and nephrologists, were critical of the reliance upon histocompatibility testing. They felt that their priorities for organ allocation were overlooked in the framework of Scandiatriplant. Tensions concerning these issues grew between immunologists and clinicians and culminated in the early 1980s in a revision of the Scandiatriplant cooperation towards diminished regional kidney exchange. Cyclosporine played an important part in this change by offering an alternative to tissue type matching, but also because critics of Scandiatriplant presented the new drug in such a way that it justified their viewpoints. The new immunosuppressant, I argue, was thus to a certain degree shaped by a professional struggle between immunologists and clinicians. My approach is thus in line with several other studies on medical innovations that emphasize the importance of competition and struggles between different groups of health care professionals.²⁶

My analysis draws on studies of articles and books published by Danish medical doctors from the mid-1960s onwards, along with archival material and interviews with persons involved in kidney transplantations in Denmark in the 1970s. These last two groups of sources allow a view of other conceptualizations of kidney transplantations than the dominant one of immunology. I am therefore able to provide a more complex picture of attitudes towards kidney exchange than the one drawn up by studies relying primarily on published material.²⁷ I will begin by presenting the 1970s’ system of regional kidney exchange. I will then turn to the clinicians’ criticism of this system, and move on to the conflict of the early 1980s and the role played by cyclosporine.

Regional Kidney Exchange

On Sunday evening 21 November 1971, a blizzard dropped a thick layer of snow over Denmark. During the night, the victim of a traffic accident was brought into the National Hospital in Copenhagen with severe head injuries. The patient was connected to a ventilator as there was no spontaneous breathing, and it was quickly established that the patient's central nervous system had been fatally damaged. Thus artificially maintaining circulation and organ function, but with no hope of returning to life, the patient was a potential organ donor. A blood sample was brought to the hospital's newly established tissue type laboratory where a histocompatibility test was carried out. The information was then faxed to the central office of Scandiatriplant at Århus Municipal Hospital in the western part of the country. There, the donor tissue type was matched against the database of all patients in the Nordic countries waiting for a kidney transplantation.

The most suitable recipient turned out to be a young boy from the north-western corner of Denmark. The kidney was an A-match, meaning that no tissue type incompatibilities could be identified between recipient and donor. As the boy's parents were only too happy to accept the kidney offered to their son, the logistical challenge of bringing the recipient and the donor organ together in a transplant centre began. Overland travel was impossible because of weather conditions, so a Navy rescue helicopter was assigned to pick up the recipient near his home. The helicopter made a stop at the boy's dialysis centre in Aalborg for his medical record, and then continued on to the nearest transplant centre at Århus Municipal Hospital. The donor

[Top](#)

[Why did Regional Kidney Exchange Decrease?](#)

■ [Regional Kidney Exchange](#)

[The Politics of Tissue Typing](#)

[The Alternative of Local Use](#)

[A Struggle between Perspectives and Specialisms](#)

[Cyclosporine and the Legitimacy of Local Priorities](#)

[Conclusion](#)

kidney arrived by helicopter from Copenhagen. Shortly after midnight on 24 November, the kidney had been implanted in the new host through an uneventful operation.²⁸

This story illustrates some important characteristics of regional kidney exchange in the 1970s, not just in Denmark but generally. Exchanging kidneys required a large and diverse organizational network aimed at bringing people, organs, and information together from considerable distances, millions of inhabitants, and several transplant centres. This complicated and bureaucratic way of allocating donor kidneys was guided by, and justified through, a belief in the beneficial clinical effects of matching donors and recipients according to tissue types. And finally, tissue type laboratories and the immunologists working in them played the central role in the allocation process.

In 1971, the central position of immunology in kidney transplantations was of recent date. According to Moulin, immunology became the dominant language in organ transplantations in the mid-1960s, and subsequent research efforts focused mainly on two immunological roads towards better clinical results: one was the prevention of rejection through immunosuppressant drugs; the other was histocompatibility testing as a basis for donor-recipient selection.²⁹ Research in immunosuppression yielded the first practical results. Experiments with full-body radiation of the recipient proved effective in the narrow sense of preventing rejection, but the sub-lethal doses of X-rays used had severe side effects, and the procedure was difficult to control. Extirpation of antibody-producing tissues like the spleen and thymus as well as drainage of lymphocyte-rich lymph from the thoracic duct yielded mixed results.³⁰ Real progress came in the shape of chemical immunosuppressants developed by American and British doctors around 1960, resulting in a combination treatment of antimetabolites and corticosteroids. This immunosuppressant regime secured a one-year graft survival rate of about 40 per cent, a remarkable improvement at the time, and remained the treatment of choice until the 1980s.³¹ The results encouraged hospitals all over the world to take up renal transplantations,³² and also convinced doctors at Århus Municipal Hospital that the time was right to move towards a transplantation programme. Their preparations involved experimental transplantations on pigs as well as study trips to transplant centres in the UK. By early 1964, the team of doctors involved was ready, and the first kidney transplantation in Denmark was performed at Århus Municipal Hospital on 18 April.³³ Kidney transplantations in Denmark thus began on the basis of advances in immunosuppression. But developments were soon to be strongly influenced by advances in the identification of tissue types and the possibility of matching donors and recipients. In 1966, when the transplant team at Århus Municipal Hospital published their experiences with their first fourteen kidney transplants, they were confident “that the use of selected donors, who differ from the recipient only with respect to a few leukocyte antigens, yields better clinical results”.³⁴

The technology for routine donor-recipient matching according to tissue types was not available at that time, but expectations of what such a selection programme might bring were enormous. Since the earliest experiments with kidney transplantations in animals at the beginning of the twentieth century, it had been clear that tissue transferred between different species (xenotransplantations) or even between individuals of the same species (allotransplantations) were invariably rejected, while tissue moved within the same individual (autotransplantations), for example a dog's kidney transplanted to its neck, was allowed to heal and function.³⁵ Experiments with skin grafts for victims of burns during the Second World War by Peter Medawar, and with kidney transplants in dogs by Morten Simonsen, a young Danish doctor working in Aalborg in the late 1940s, led to the conclusion that rejection was an immunological process caused by differences in tissue types between host and graft.³⁶ These results motivated further interest in transplantation immunology. In 1957, the medical faculty at the University of Copenhagen set up an Institute of Transplantation and Immunobiology with Morten Simonsen as director. According to Simonsen, this novel and not easily classifiable research area was met with so much opposition from doctors within other specialities, especially surgeons, that work in the new institute did not begin until ten years later, in 1967.³⁷

By that time, transplantation immunology had moved from a marginal position to being central to kidney

transplantations. Matching of donor and recipient according to tissue antigens was accepted internationally as the road to safer transplantations, and technical improvements now allowed the identification of such antigens in practice.³⁸ The search for specific antigens active in the rejection of foreign tissue had begun in haematology departments in the late 1950s. Over the next decade, a small group of researchers scattered in laboratories across the world explored the group of antigens, from 1967 known as the HL-A and later the HLA (Human Leukocyte Antigen) system, which were believed to be most important in organ transplantation.³⁹ In 1964, two American transplant centres began retrospective and soon after prospective studies of the relationship between donor-recipient selection according to HLA and the outcome of kidney transplantations. At this time, it was possible to identify only a small number of antigens in the HLA system and results from the tests were correspondingly unclear, but with some indication of a correlation between good matches and prolonged graft survival rates.⁴⁰ The studies spawned a major increase in tissue type testing and in the possibility of matching donors and recipients. According to the American transplant surgeon Thomas Starzl, who participated in the first experiments with donor selection, “a cottage industry of clinical tissue typing based on the assumption that matching would have a profound influence on transplantation had sprung up worldwide” by 1966.⁴¹ Morten Simonsen was one of the researchers convinced that tissue typing would bring about a revolution in kidney transplantation. In the *Lancet* in early 1965, he argued that rejection or acceptance of kidney grafts was probably determined by a quite simple system of histocompatibility antigens, comparable to that of the major blood types.⁴² Reliable and more sensitive techniques for tissue type testing still had to be developed if a donor-selection system should become a practical possibility. And he spurred on research in this area by speculating that “serological identification of some—perhaps no more than four to seven—of the strongest antigens could lead to a radical improvement in the results”.⁴³

Simonsen's statement is a clear example of what Moulin calls the “HLA-hypothesis”, the belief that variation in the HLA-system was sufficiently limited to justify the search for donors that were compatible with recipients, and that such compatibility would bring about better clinical results.⁴⁴ In the mid-1960s, this hypothesis was spreading from the small community of HLA-researchers to transplant teams, and it was to have a huge effect on the future of kidney transplantations. It focused research efforts on the identification of leukocyte antigens and it shaped the organization of kidney transplantations since organ exchange according to tissue types now appeared not only reasonable but even imperative.⁴⁵

The HLA-system quickly proved to be much more complicated than envisioned by Simonsen, with even the most frequent HLA-phenotypes being present in only a fraction of the population.⁴⁶ But rather than deterring the practical implementation of the HLA-hypothesis, polymorphism was seen as a problem that could be solved by making the available pool of potential recipients larger. Jon van Rood, head of the blood bank in Leiden and a central member of the “HLA fraternity”,⁴⁷ was the first to bring these thoughts into practice. At the Third Histocompatibility Workshop held in Turin in September 1967, he revealed his plans for Eurotransplant, a kidney exchange organization that would unite the efforts of tissue type laboratories and transplant teams in Holland, Belgium, Luxemburg and parts of West Germany in an attempt to supply patients waiting for transplantation with a well-matched donor kidney.⁴⁸ Eurotransplant would maintain a database of tissue type information on patients waiting for a new kidney. “When one of the cooperating teams is notified that it will receive a cadaver kidney, the potential donor can be typed for blood and leukocyte groups; if this team has no suitable recipient a telephone call to the computer [containing the database] will locate the best-matched recipient(s) in a matter of minutes”.⁴⁹ The Eurotransplant office in Leiden received its first cadaver kidney report in October 1967, thus marking the beginning of large-scale regional kidney exchange.⁵⁰

The establishment of Eurotransplant spawned a series of similar initiatives in European regions. In Denmark, Flemming Kissmeyer-Nielsen, head of the blood bank at Århus Municipal Hospital and also a member of the international HLA-research community, quickly saw the need for a similar organization for the Nordic countries.⁵¹ At the conference in Turin, Kissmeyer-Nielsen presented a modified and easily reproducible

test method well suited to allow cooperation between different tissue type laboratories.⁵² Upon his return, he informed the Committee on Dialysis and Transplantation set up by the Danish National Board of Health that a regional organization similar to Eurotransplant was a prerequisite for the effective utilization of cadaver kidneys.⁵³ In early 1968, he aired plans for an exchange programme between the transplant centres in Copenhagen and Århus, and by August that year his plans also included transplant centres in Sweden and Norway, with the tissue type laboratory at Århus Municipal Hospital as the main centre.⁵⁴ Through the autumn, further talks were held between representatives of these centres, also securing the support of national health care authorities, and in January 1969 the transfer by helicopter of a kidney from Gothenburg to Århus marked the start of Scandiatransplant. In 1970, the organization was enlarged to include all the Nordic countries and, for a few years, also the Hamburg region.⁵⁵

Scandiatransplant was an immediate success. During the first two years, 278 out of a total of 430 transplants were carried out with a kidney transferred from one centre to another.⁵⁶ In 1971, the exchange rate was close to 75 per cent. That figure is striking in light of the fact that by this time the Scandinavian countries had some of the highest kidney transplantation rates in the world, with Denmark taking the overall lead.⁵⁷ Kidneys that could not be matched to a suitable recipient in the Nordic countries were exchanged with Eurotransplant or other organizations,⁵⁸ and sometimes with transplant centres in the USA.⁵⁹ Kidney transplantation had become a potentially globalized affair.

The involvement of Danish transplant centres in regional kidney exchange meant that transplantation became an organizationally very complicated procedure which relied heavily upon infrastructure, technology, and networks of communication. The backbone of Scandiatransplant, the database containing tissue type information on all patients waiting for a kidney transplant in the region, about 200 to begin with but quickly rising to 600 in 1973, had to be maintained in both a safe and an accessible manner. This was initially achieved through a punch-card system at the tissue type laboratory at Århus Municipal Hospital.⁶⁰ In 1974, the registry was moved to a computer which allowed tissue type laboratories and transplant centres online access to the database.⁶¹ Initially, the cooperating centres communicated with the main office in Århus by telephone, until telex-machines took over around 1971. Effective and speedy cooperation of many different institutions had to be made possible through the standardization of a number of tools and procedures, ranging from test sera for histocompatibility testing, the test methods themselves, the reporting of test results, and information on the recipients. The tissue type laboratory in Århus was responsible for producing and distributing test sera to the other tissue type laboratories in order to secure comparable results. For the transportation of organs, Scandiatransplant relied heavily on the services of commercial airlines, national air forces, and private taxi planes. In the framework of Scandiatransplant, kidney transplantations thus became a highly complex and bureaucratic business involving many different kinds of technologies and institutions. Similar developments towards large and diverse organizational frameworks for kidney exchange could be seen in other regions in Europe where exchange organizations were set up.⁶²

The Politics of Tissue Typing

Kissmeyer-Nielsen admitted that the exchange system put into effect with Scandiatransplant was both complicated and expensive.⁶³ But the organization enjoyed support from many sides. Developments in kidney transplantation attracted much media attention around 1970, and the focus was usually on the role played by Scandiatransplant and Kissmeyer-Nielsen.⁶⁴ Stories of kidney transports, with their inherent features of drama, the race against time, and the question of life and/or death, often found their way to the newspapers.⁶⁵ During this period, Kissmeyer-Nielsen became the public face of kidney transplantation in Denmark, and he used this position to promote the unique importance of immunology and a regional perspective in organ exchange for the future of kidney transplantation. Newspapers told of plans for a world-organization for kidney exchange, and Kissmeyer-Nielsen assured readers of the rationality of such a network: “With the international cooperation we have, both regarding tissue typing and organ exchange, we

[Top](#)

[Why did Regional Kidney Exchange Decrease?](#)

[Regional Kidney Exchange](#)

■ [The Politics of Tissue Typing](#)

[The Alternative of Local Use](#)

[A Struggle between Perspectives and Specialisms](#)

must be getting close to a 100 per cent certainty that the kidney will be accepted”.⁶⁶ The message was certainly picked up, with one editorial stating that “thanks to the fantastic international cooperation recounted by Dr Kissmeyer-Nielsen last Sunday, histocompatibility tests may now be carried out with such precision that no element of chance remains when a patient is to receive a cadaver kidney”.⁶⁷

In articles and books aimed both at popular and medical audiences, Kissmeyer-Nielsen promoted the view that tissue typing together with a large pool of recipients were the main requirements for positive results in kidney transplantation and that improvements in graft survival would come from immunology in the shape of more sensitive methods of donor-recipient selection.⁶⁸ Kissmeyer-Nielsen thus became the most prominent advocate of the HLA-hypothesis in Denmark.⁶⁹ But he was far from alone in framing kidney transplantations this way. Indeed, the National Board of Health's Committee on Dialysis and Transplantation, numbering all the senior doctors involved in kidney transplantation at the time, affirmed the view. In the committee's first report in 1969, Jørn Hess Thaysen, head of the nephrological department at the National Hospital and chairman of the committee from its beginning to the end in 1993, stated that “regional cooperation” on the basis of tissue type data was necessary in order to improve the results of cadaver kidney transplantations.⁷⁰

The system of regional organ exchange thus enjoyed the support of powerful actors in the Danish health care field around 1970. But before we accept this support as no more than the result of rational surveys of the matter at hand, we should pay attention to the political aspects of this way of conceptualizing kidney allocation. Moulin argues that promoting the importance of tissue typing served a strategic purpose since it justified both the regional kidney exchange organizations and the centrality of tissue type laboratories and immunologists in the organization of kidney transplantations.⁷¹ Kissmeyer-Nielsen made just such an argument concerning the structure of Scandiatransplant. He stated that “even though other factors in some cases influence the choice of recipient, the tissue types of donor and recipient are the most important, and for that reason it is natural that the tissue type laboratories in the region, which are the central links of communication, locate the best suited recipients and establish the necessary contact between donor- and recipient-centres”.⁷² At the same time, other conceptualizations of kidney transplantation, alternative modes of organization, along with competing research foci and medical specialities, were marginalized. For example, Kissmeyer-Nielsen argued in 1972 that, while the immunological aspects of kidney transplantation continued to pose the main challenge, “the surgical-technical problems are largely solved”.⁷³ Kissmeyer-Nielsen thus justified a continuing research focus on immunogenetics while also removing the status of transplant surgery as an object of scientific interest.⁷⁴ His call for intensified interest in transplantation immunology did not fall on barren ground. On the recommendation of the National Board of Health's Committee on Dialysis and Transplantation, the Danish parliament decided to support research in dialysis and transplantation through a special fund of 1 million kroner, to be distributed through the Medical Research Council in 1969–70. More than 400,000 kroner went to research in transplantation immunology, while a mere 30,000 went to the study of surgical aspects, more precisely the functioning of the ureter upon transplantation.⁷⁵

The rationality of tissue typing thus guided the way cadaver kidneys were exchanged in Denmark during the 1970s, and tissue type laboratories occupied the central position in the complicated network required to make regional kidney exchange work. But even if immunology and institutional kidney exchange provided the dominant framework for thinking about transplantation during this period, an alternative favouring local use of kidneys and less reliance upon histocompatibility existed. In order to identify this alternative, we must return to the story of the transplantation given above.

The Alternative of Local Use

The morning after the transplantation at Århus Municipal Hospital, Flemming Kissmeyer-Nielsen telephoned Arne W S Sørensen, the nephrologist who had been in charge of the boy's dialysis treatment. The patient

- Exchange
- The Politics of Tissue Typing
- The Alternative of Local Use
- A Struggle between Perspectives and Specialisms
- Cyclosporine and the Legitimacy of Local Priorities
- Conclusion

Med Hist

was doing well, but Kissmeyer-Nielsen had disturbing news nevertheless. The tissue type information on the telex from Copenhagen had been either unclear or misread. In any case, wrong information had been used to locate the most suitable recipient in the Scandiatransplant database, and it now turned out that rather than an A-match kidney, the boy had been equipped with a D-match. The donor kidney had at least two antigens foreign to the recipient. This meant a much lower chance that the new kidney would function beyond a few weeks or months. Consequently, the boy would never have been chosen as recipient if the true character of the match had been known. Little could be done now, however, since Kissmeyer-Nielsen was certainly not going to suggest that the kidney be removed and given to someone else. But the information was important to Sørensen since he would be in charge of the follow-up treatment. More severe rejection episodes could now be expected and the patient would probably have to endure a heavier immunosuppressant regime.

The new kidney did indeed present problems. Another three operations were required to attach the ureter properly to the kidney, a common problem in many transplantations, and the patient did not return home until a month later. But apart from that the kidney worked well and it continued to do so for twelve years when chronic rejection set in and it had to be removed. A period of dialysis followed until the patient received his second kidney transplantation.⁷⁶

Med Hist

The story of how a grossly mismatched kidney graft managed to function and thereby save the life of a young boy was obviously a happy one, and Kissmeyer-Nielsen must have been relieved that the faulty selection procedure did not result in acute rejection. But we may also expect Kissmeyer-Nielsen to have been glad that this part of the story was not brought to wider attention. Cases showing a lack of correlation between tissue type match and transplantation outcome not only went directly against Kissmeyer-Nielsen's scientific claim that HLA should guide the pairing of donor organ and recipient, they also carried organizational and professional-political connotations: they undermined the rationality of regional kidney exchange through organizations like Scandiatransplant, and called into question the central role played by immunologists and tissue type laboratories in kidney transplantations and the allocation of organs. In short, such cases suggested an alternative to regional kidney exchange, namely local use of kidneys at the expense of the HLA-match.

Med Hist

The question of the actual benefits of HLA as a basis for organ allocation has been one of the most controversial in the history of kidney transplantation on an international level. At a conference in The Hague in September 1970, Paul Terasaki, head of the UCLA Tissue Typing Laboratory, presented results showing little correlation between histocompatibility and graft survival.⁷⁷ Terasaki had pioneered donor selection according to HLA in 1964, thereby inspiring much of the enthusiasm about tissue typing. Now he questioned the limits of this technology. According to Terasaki, however, “the heretical paper ... was completely unacceptable to tissue typers”.⁷⁸ Soon after the meeting in The Hague, “emergency” conferences were called by tissue typers, all ending in reaffirmations of the HLA-hypothesis.⁷⁹ The National Institutes of Health, which funded much of the HLA-research in the USA, withdrew funding from Terasaki's laboratory within four months of the conference in The Hague. Further, Terasaki's paper was the only contribution not included in the proceedings of the conference.⁸⁰

The paper was eventually published in 1971 in the first issue of *Tissue Antigens*, a new journal edited by Kissmeyer-Nielsen and serving the growing field of tissue typing.⁸¹ It was, however, preceded by an editorial in which Kissmeyer-Nielsen, “in order to stress the undisputable importance of the HL-A system for human transplantation, which is generally agreed upon by all tissue typers”, warned of possible sources of error in Terasaki's data.⁸² Terasaki and his team had challenged the relevance of HLA-typing directly by saying that since many patients experienced good transplantation results even with mismatched kidneys, “a more suitable means by which successful transplants can be predicted will be required”.⁸³ That is, the clinical benefits of HLA-typing were so unclear that it was not currently justified as a basis for organ allocation. Kissmeyer-Nielsen strongly opposed this view. The difficulties in establishing correlation between match grade and clinical results, which he believed to stem primarily from “inaccurate HL-A typing ... should not

be used as an excuse to disregard the HL-A system in relation to clinical transplants”.⁸⁴ Rather, the “complicated and expensive” work carried out by organizations like Scandiatriplant should be continued, just as “research in all aspects of HL-A typing should be given high priority”.⁸⁵

Kissmeyer-Nielsen had good reasons for wanting to put an end to debates among immunologists over the relevance of tissue typing. Within Scandiatriplant, reliance upon histocompatibility was coming under attack in the early 1970s, mainly from surgeons and nephrologists. As mentioned above, Scandiatriplant had a remarkable initial success, exchanging almost three-quarters of all cadaver kidneys in 1971. Yet in the following years, statistical analyses of Scandiatriplant material showed poor correlation between match grade and clinical results.⁸⁶ The results were never published, and the reliance upon tissue typing was not openly challenged at this time. But the statistics made a strong impression on clinicians. The lack of correlation justified extensive use of kidneys for local patients rather than sending grafts on to another centre. As a consequence, transplant teams chose to disregard exchange criteria to such a degree that the exchange rate through Scandiatriplant dropped to 35 per cent in 1975, half that of four years earlier.⁸⁷ Exchange criteria in Scandiatriplant were loosened, and the Committee on Dialysis and Transplantation even speculated that kidney exchange on a regional level might soon come to an end.⁸⁸

Scandiatriplant survived, and exchange rates rose to around 50 per cent in the late 1970s because of expectations concerning HLA-DR typing.⁸⁹ But it is clear that two different attitudes toward organ allocation existed within the system of kidney transplantation from the early 1970s onwards, and that immunologists and clinicians took different sides. Next to the official policy of allocation on the basis of histocompatibility, advocated mainly by immunologists, an alternative practice of kidney allocation was at times employed by clinicians. Kissmeyer-Nielsen believed “transplant surgeons” to be more than happy to disregard HLA in the allocation of kidneys.⁹⁰ And in 1982 he recalled how “tissue typers in Scandinavia have experienced depressing episodes” as reports suggesting a limited value of histocompatibility testing had brought “kidney surgeons” to use more donor kidneys locally in non-compliance with exchange criteria.⁹¹ Clinicians rarely put their criticism of tissue typing into words, and then only discreetly. The Committee on Dialysis and Transplantation, which was dominated by urologists and nephrologists, stated in 1973 that tissue typing played a “significantly smaller role” in cadaver kidney transplantations than grafts from living related donors, thus moderating the enthusiasm of their 1969 report.⁹² Rather, clinicians chose simply to disregard HLA in practice whenever they thought this justifiable, thus allowing the drop in exchange rates in Scandiatriplant to speak for itself. A similar situation may be observed in other countries. According to Jean Dausset, who headed France-Transplant for the first twenty years of its existence, surgeons were always strongly opposed to HLA and regional kidney exchange, even if they were unwilling to enter into an open discussion about the issue.⁹³ And Nicholas Tilney informs us that while tissue typers were relatively unaffected by reports questioning the practical importance of HLA, surgeons quietly bypassed tissue type laboratories in the allocation process.⁹⁴

In this way, a gap was apparent between the perspective of immunologists in favour of regional kidney exchange and the outlook of clinicians who preferred and sometimes practised local allocation. Even though the former view was dominant, the 1970s can be seen as a period of confrontation between regional and local perspectives in kidney allocation. Diverging preferences for organ allocation were to play a central role in the changes that took place in Nordic kidney exchange in the 1980s, and it is worth taking a look at some of the factors that led doctors in different directions.

A Struggle between Perspectives and Specialisms

In her analysis of sources of conflict in the Swedish transplantation system, Nora Machado points to how tensions may arise because different groups of doctors involved in the system have diverging priorities. Clinicians in transplant centres feel responsible for local patients, while doctors primarily involved in kidney

distribution focus on overall efficiency.⁹⁵ Such differences in perspective were probably a central reason for diverging attitudes towards regional kidney exchange. Disagreement was not over the use of immunogenetic characteristics as criteria for kidney allocation. To the degree that tissue typing had a positive influence on graft survival, clinicians were happy to use it.⁹⁶ Löwy argues that HLA was in fact attractive to clinicians because it defused potential conflicts with patients by “naturalizing” the allocation procedure.⁹⁷ Histocompatibility offered an apparently neutral scientific guide for surgeons and nephrologists to refer to in “the delicate political matter of organ allocation”.⁹⁸ Löwy also suggests that the equality in access to donor kidneys offered through reliance upon HLA was in line with the values guiding health care provision in European countries.⁹⁹ Ole Fjeldborg, the most experienced kidney transplant surgeon in Denmark, supported this view by stating that Scandinavians would not accept allocation “on anything but biological grounds”.¹⁰⁰

The question that divided immunologists and clinicians in Denmark, and probably also elsewhere, was whether histocompatibility was so important that kidneys should be exchanged between different transplant centres in order to achieve an optimal match. Immunologists argued that regional kidney exchange was warranted even if well-matched cadaver kidney grafts fared only slightly better than mismatched ones. For clinicians, such minor benefits were seen to come with a range of drawbacks, mainly because organizations like Scandiatransplant interfered with the priorities of individual transplant centres. Clinicians were not able to concentrate on “their own” patients. And the fragmentation of the transplantation process characteristic of regional kidney exchange meant that a transplant centre might not receive as many kidneys as it procured.

Before the establishment of Scandiatransplant, cadaver kidneys for transplantations in Denmark came from patients maintained on artificial circulation in the neurosurgical department of the hospital where the transplant centre was located. The only selection criterion was major blood group compatibility, and transplant centres could count on finding a suitable recipient among their dialysis population for any donor kidney they might procure. The recipient could be brought in, prepared, and anaesthetized before the donor nephrectomy was carried out.¹⁰¹ Kidney transplantations were thus performed in a local framework and with a close connection in space, time, and quantity between procurement and implantation of kidney grafts.

Scandiatransplant disrupted the direct link between procurement and transplantation. A transplant centre did not have to procure a kidney in order to implant one, and, since grafts might come from all over Scandinavia or even from other regions in Europe, donation and transplantation depended on each other only in a very abstract way. As a consequence, the actual process of donation and the number of kidneys procured by each centre was seen to be of little importance in the management of Scandiatransplant. The first Scandiatransplant report stated that “430 cadaver kidneys have been procured”, 65 per cent of which were sent on to another centre, and supplied information on histocompatibility and transplantation outcomes.¹⁰² The institutional origin of donor kidneys was not considered relevant.

This was not so for transplant teams. Kidney procurement was a very real task in individual hospitals, a time-consuming one, and not a very attractive one either. The first major conflict in Denmark about kidney transplantation broke out as nurses from the neuroanaesthetic department at Århus Municipal Hospital refused to participate in deceased donor nephrectomies, which they deemed to be both illegal and unethical. The nurses claimed that kidneys were removed while the donor was still maintained on artificial ventilation, and that relatives were not informed, or were even lied to, in order to allow the nephrectomies to be carried out.¹⁰³ Medical doctors accused nurses of obstructing life-saving operations, and the conflict threatened to bring transplantation activities at the hospital to a halt.¹⁰⁴ Legislation regulating the donation of organs and tissue for transplantation was rushed through the Danish parliament in 1967 in order to establish a firm legal ground for these procedures, but a latent conflict between medical doctors and nurses continued to influence kidney procurement for several years.¹⁰⁵ Even when things calmed down, nephrectomies on deceased donors were still “the most unattractive operation one might imagine”, carried out in highly emotional circumstances and in a legal and ethical grey area.¹⁰⁶ The only thing that merited the effort was the

subsequent implantation of the organ into a chronic uraemic patient. Chronic uraemics spend extended and repeated periods of time in hospital and often build up personal ties with the staff. Just like the procurement process, possible recipients of donor organs were very much faces to transplant teams. There is, therefore, little reason to believe that clinicians lightly gave up donor kidneys for transfer to another hospital.¹⁰⁷

Yet that was exactly what the Scandiatransplant organization required transplant centres to do. And, to make matters worse, the donating institution could not count on receiving a graft in return. Imbalances were visible from the very beginning of kidney exchange in the Nordic countries. During the first three years of Scandiatransplant, Danish transplant centres procured a total of 271 cadaver kidneys. Of these, 178 were sent to a centre in another country, but since 317 transplants using cadaver kidneys were performed during that period, Denmark imported over forty kidneys more from Scandiatransplant partners than were exported.¹⁰⁸ Differences existed between the procurement and exchange rates of the different Danish centres. Århus Municipal Hospital procured sixty-two kidneys and transferred twenty of them to hospitals outside Denmark. The Copenhagen region, numbering two transplant centres, procured 117 kidneys during the same period and exported half of them. By 1976, the situation had only become more uneven. Danish transplant centres were using far more kidneys than they procured, with the transplant centres in Sweden and Norway doing much of the exporting.¹⁰⁹ The deficit continued to grow, so that by the end of 1981 Danish transplant teams had received a total of 317 kidneys more from Scandiatransplant partners than they had transferred.¹¹⁰

The clinicians found this situation difficult to accept. Objections were voiced in private circles during the 1970s, but the complaints seem to have carried little weight during that decade.¹¹¹ Within the rationality of the HLA-hypothesis promoted by Kissmeyer-Nielsen and other tissue typers, such a deficit was largely accidental. Scandiatransplant did have a rule that kidneys should be repaid in kind within six months.¹¹² But since transplant teams had no control over the tissue types of the kidneys they procured, they could not be held responsible if they failed to repay kidneys. Official reports from Scandiatransplant never touched upon the growing problem of imbalances in kidney exchange.¹¹³ The reliance upon tissue typing thus overlooked and even naturalized a potentially uneven way of distributing organs between institutions, even as the dissatisfaction of clinicians grew. By the early 1980s, it was clear that tensions over such imbalances were reaching a critical point. The Danish Committee on Dialysis and Transplantation acknowledged in 1981 that Swedish and Norwegian frustrations over the Danish kidney debt “threatened cooperation within the Scandiatransplant organization in a serious way”.¹¹⁴ Regional kidney exchange thus appeared to be under pressure. Within a couple of years, calls for a revision of kidney allocation practices gained momentum and legitimacy from the introduction of a new immunosuppressant drug, cyclosporine.

Cyclosporine and the Legitimacy of Local Priorities

In 1982, a European multicentre trial of cyclosporine showed marked improvements in kidney graft survival. A one-year graft survival rate of around 80 per cent could be expected, compared to the 40 to 60 per cent that had proved to be the limit with traditional immunosuppressants.¹¹⁵ In Denmark, transplant centres reacted with guarded optimism, but the first Danish report on the effects of the drug confirmed previous findings.¹¹⁶

With cyclosporine, transplantation results did not seem to be affected by histocompatibility. A high survival rate was achieved irrespective of tissue type match. Therefore, the number of suitable recipients for a given donor kidney grew dramatically with the advent of cyclosporine, making it likely that any transplant team would find a match among their own dialysis population. With these characteristics, cyclosporine played into the hands of clinicians favouring the local allocation of donor kidneys. Through reference to the new drug, an apparently disinterested attack could be launched on regional kidney exchange and the dominance of the tissue typers. Jørgen Ladefoged, chief nephrologist at the National Hospital, quickly foresaw that “with the

[Top](#)

[Why did Regional Kidney Exchange Decrease?](#)

[Regional Kidney Exchange](#)

[The Politics of Tissue Typing](#)

[The Alternative of Local Use](#)

[A Struggle between Perspectives and Specialisms](#)

■ [Cyclosporine and the Legitimacy of Local Priorities](#)

use of cyclosporine ... the time-consuming exchange of kidneys between European countries and within Scandinavia, which has so far been necessary in order to achieve optimally histocompatible kidneys, will decrease markedly".¹¹⁷ Similar predictions were voiced internationally, with many early observers arguing that with cyclosporine, regional organ exchange would be at best irrelevant but most likely harmful to graft survival. The drug was shown to be nephrotoxic in humans, a side effect that was reported to worsen if kidneys were preserved outside the body for extended periods, as was the case in regional kidney exchange.¹¹⁸ One report even presented data that showed superior graft survival for unmatched kidneys with the use of cyclosporine.¹¹⁹ In the cyclosporine era, kidney exchange organizations and tissue typing laboratories seemed destined to play a more marginal role.

Med Hist

The new conditions for kidney exchange imposed by cyclosporine forced ScandiTransplant onto the defensive in the early 1980s. In 1985, the organization decided to all but abandon the exchange of kidneys on the basis of HLA-match, leading to a steep decline in exchange rates.¹²⁰ Even with such loosened guidelines for organ exchange, non-compliance with exchange criteria became widespread.¹²¹ The disruption of Nordic kidney exchange was certainly not to the benefit of Danish transplant teams, who had relied heavily upon kidneys from other hospitals. Even before cyclosporine was widely introduced, the Committee on Dialysis and Transplantation had realized that Danish centres would have to procure more kidneys locally, both in order to secure the supply of donor organs in case ScandiTransplant came to an end and in order to pay back Denmark's kidney debt.¹²² In 1984, the Danish health authorities agreed to remunerate transplant centres for every donor nephrectomy carried out, and the Committee on Dialysis and Transplantation recommended that transplant centres should be allowed to hire surgeons to form teams that could travel to hospitals in the local area and collect kidneys from suitable donors there.¹²³ Not everyone abandoned the idea of regional kidney exchange as a solution to organ shortage, but this approach had little support. In 1986, suggestions were made for the establishment of DanTransplant, a cooperation between Danish transplant centres for the exchange of kidneys on the basis of HLA-DR match, but nothing came of these plans.¹²⁴ The local and clinical aspects of kidney transplantation thus gained in importance in the mid-1980s, with around 85 per cent of all cadaver kidneys now being used at the hospital where they were procured and allocated according to criteria established by local clinicians.

Med Hist

Other European exchange organizations also went through fundamental changes in the 1980s, resulting in less reliance upon HLA.¹²⁵ Eurotransplant and France-Transplant gradually changed their objectives and functions from being mainly organ allocation organizations playing a central and indispensable role in the day-to-day functioning of kidney transplant services to being organizations largely for monitoring transplantation activities and supplying material for the study of factors important in clinical outcomes.¹²⁶ Changes were also visible in the relations of power and prestige between immunologists and clinicians. Moulin recounts how surgeons forcefully distanced themselves from tissue typing and the role played by immunologists in kidney allocation.¹²⁷ In the opinion of Jean Dausset, surgeons backed by cyclosporine were offensively bold towards tissue typers in their process of liberation "from the constraint of HLA" that they had always felt uncomfortable with.¹²⁸ His frustration is understandable to a certain degree. Within a few years, both the detrimental effects of prolonged ischemia times and of tissue type matching in combination with cyclosporine were called into question.¹²⁹ But by then the previous relationship between the immunological and other perspectives could not be reinstated. The debate over the relevance of tissue typing continued, but in a new manner. Immunology now provided only one perspective among many in the process of cadaver kidney allocation.

Med Hist

 Top

Why did Regional
Kidney Exchange
Decrease?

Regional Kidney
Exchange

Conclusion

The decrease in regional kidney exchange in Scandinavia was tied to the advent of cyclosporine even as changes in kidney allocation were beginning to happen. As shown at the beginning of this paper, the introduction of this new immunosuppressant has since then been seen as the main cause of the change from a

M

- The Politics of Tissue Typing
- The Alternative of Local Use
- A Struggle between Perspectives and Specialisms
- Cyclosporine and the Legitimacy of Local Priorities

■ Conclusion

Med Hist

regional to a local perspective in cadaver kidney allocation. Yet the study of developments in kidney allocation in Denmark demonstrates how diverging perspectives and priorities among different groups of doctors played an important part in the changes in regional kidney exchange in the 1980s, and thus brings into question the role played by cyclosporine. Changes were not brought about as a direct result of pharmacological innovations. Cyclosporine was introduced at a time when conflict between immunologists favouring regional kidney exchange and clinicians focused on conditions at local transplant centres was reaching a climax. Tensions had been mounting throughout the 1970s, and even though immunologists and tissue type laboratories held a dominant position in the kidney transplantation system, clinicians sometimes disregarded exchange rules and allocated organs locally, thus maintaining an alternative to regional kidney exchange. This alternative was not created by the advent of cyclosporine. Rather, the new drug legitimized the views held by clinicians dissatisfied with the dominant system. Cyclosporine was woven into the struggle between different doctors working on different aspects of kidney transplantation and holding opposing views of how to allocate donor organs. To a degree, the drug was shaped to serve the interests of one of these factions.

Med Hist

The Danish case thus corresponds with the view of innovation and change in medicine presented in several historical studies from the early 1990s onwards. The innovation brought about by cyclosporine was constituted through a range of social and cultural factors. Yet the Danish case does not suggest that norms and values regarding access to health care services, as discussed by Löwy and Moulin, played the primary role in changing the structure of institutional kidney exchange. Whether they were immunologists or surgeons, doctors in Danish transplant centres worked in the same health care system and still managed to hold opposing views on the relevance of tissue typing and regional kidney exchange. The conflict between different doctors was not over whether equality should be the guiding principle in health care provision, but rather over the level at which equality should be sought. And finally, these broad socio-cultural values did not go through abrupt changes against which changes in kidney allocation in the 1980s can be mapped.

Med Hist

The Danish case does not, however, suggest that we should completely discard pharmacology or broad socio-cultural values in our understanding of the decrease in regional kidney exchange. Cyclosporine did not cause changes in organ allocation in any direct way, but it is clear that the alternative of local allocation gained decisive momentum when presented in the guise of immunosuppressive innovation. Therefore, even if professional struggles are accepted as an important dynamic in the history of organ allocation, it is difficult to explain why opposition from clinicians caused a revision of exchange criteria in the 1980s when it failed to do so at an earlier date without allowing for a degree of agency on the part of cyclosporine. The drug seems to have offered a unique opportunity to present a socio-professional demand as a neutral scientific imperative, and the historical circumstances that allowed this merit further investigation. Also, in the 1970s climate of uncertainty regarding the actual role of HLA in kidney transplantations, an adherence among all kinds of doctors to the ideal of equality in access to health care services is likely to have made an apparently neutral allocation process on the basis of histocompatibility more attractive than the local alternative, which might more easily be seen as arbitrary. Such an interpretation may also go some way towards explaining another interesting feature of the history of kidney allocation in Denmark, namely the divide between official discourse and actual practice that existed through the 1970s. Repeated affirmations of the benefits of tissue typing went hand in hand with frequent disregard for histocompatibility in the allocation process. We might argue that the “non-scientific” ideal of equality in health care provision stressed by Löwy and Moulin prevented an alignment of discourse and practice. Such an interpretation would, however, have as a premise that a gap between the actions and attitudes of different doctors is an anomaly that requires explanation. Another approach would argue that the existence of different, even contradictory, viewpoints is the norm within complex systems of cooperation.¹³⁰ In the latter perspective, our interest should focus on how intra-professional differences have been handled in the history of kidney sharing in general, and not just in the 1970s.

Med Hist

In sum, the history of kidney allocation in Denmark presents a more complex image of the dynamics

involved in this area than has previously been described, and points to new questions. One way to pursue these questions would be to compare the Danish case with that of kidney exchange in other countries and regions. As noted, the Danish framework for kidney allocation differed from that of other countries on several points, for example in the way that kidney transplantation organization was strongly influenced by health care authorities.¹³¹ For this reason, differing perspectives among doctors may have been relatively less important for developments in Denmark than in countries with less governmental control. In any case, the focus on tensions between different groups of doctors rather than on general factors, be they pharmacological innovations or broad socio-cultural values, suggests that further studies of how the institutional exchange of organs for transplantation has unfolded in different regions are desirable.

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Footnotes

¹ On different kinds of donor-recipient exchanges, see Renée C Fox and Judith P Swazey, *The courage to fail: a social view of organ transplants and dialysis*, University of Chicago Press, 1978, pp. 5–39. Fox and Swazey stress the reciprocity involved in organ donation even when the graft is presented as a gift, and draw on the work by Marcell Mauss on gift exchange. See also Nancy Scheper-Hughes, ‘The global traffic in human organs’, *Curr. Anthropol.*, 2000, **41**: 191–224; Margaret Lock, *Twice dead: organ transplants and the reinvention of death*, Berkeley, University of California Press, 2002, pp. 315–40; Anne Hambro Alnæs, *Minding matter: organ donation and medical modernity's difficult decisions*, Oslo, Department and Museum of Anthropology, Faculty of Social Sciences, University of Oslo, 2001.

² Fox and Swazey, op. cit., note 1 above, p. 376; *idem*, *Spare parts: organ replacement in American society*, New York, Oxford University Press, 1992.

³ Jeffrey M Prottas, ‘The politics of transplantation’, in B Spielman (ed.), *Organ and tissue donation: ethical, legal, and policy issues*, Carbondale, Southern Illinois University Press, 1996, pp. 3–18, on p. 5.

⁴ Prottas, op. cit., note 3 above.

⁵ Since kidneys from living donors are only rarely exchanged between transplant centres, my focus in the rest of this article is exclusively on the allocation of kidneys from deceased donors. Systematic institutional exchange of kidneys from living donors has been suggested, see, for example, Ejvind Kemp, Jørn Giese, and Paul Peter Leyssac, *Clinical transplantation, xenotransplantation and stem cell medicine*, Copenhagen, Munksgaard, 2003, pp. 18–20; E S Woodle, ‘A history of living donor transplantation: from twins to trades’, *Transplant. Proc.*, 2003, **35**: 901–2.

⁶ The history of kidney transplantations in Denmark is presented in Eva Bundegaard, *Danske nyretransplantationer: om pionerer og idealister*, Copenhagen, Dansk Nefrologisk Selskab, 1999. For a comparative overview of developments in different European countries, see Michael A Bos, *The diffusion of heart and liver transplantation across Europe*, London, King's Fund Centre, 1991.

⁷ Jørn Hess Thaysen, *Dialyse og nyretransplantation. Organisation af behandling. Indberetning nr. 3 fra sundhedsstyrelsens dialyse og nyretransplantationsudvalg*, Copenhagen, Sundhedsstyrelsen, 1980, p. 30.

⁸ Melvin Madsen, *et al.*, 'Application of human leukocyte antigen matching in the allocation of kidneys from cadaveric organ donors in the Nordic countries', *Transplantation*, 2004, **77**: 621–3; Melvin Madsen, 'Scandiatransplant: Nordic collaboration in organ transplantation', in S A Birkeland (ed.), *Transplantation in Denmark*, Odense, The Danish Society for Transplantation, 1997, pp. 76–83.

⁹ In contrast, transplant centres in the USA went through somewhat opposite development during those same years, with more kidneys being exchanged in the late 1980s than in the 1970s, where the centres procured organs almost exclusively for their own use. Prottas, *op. cit.*, note 3 above, p. 6; Alan Ting and Leah Bennett Edwards, 'Human leukocyte antigen in the allocation of kidneys from cadaveric donors in the United States', *Transplantation*, 2004, **77**: 610–33. See also Guenter B Risse, *Mending bodies, saving souls: a history of hospitals*, New York, Oxford University Press, 1999, pp. 571–2.

¹⁰ Rudolph Pichlmayr, '10 Jahre Eurotransplant. Rückblick, Gegenwart und Zukunft von Transplantationen', *Fortschritte der Medizin*, 1977, **95**: 2789; Jon J van Rood, 'The Eurotransplant story. Part 1: The beginning', *Dialysis & Transplantation*, 1982, **11**: 515–20; J A van der Does, 'The Eurotransplant story. Part 2: 1967, the year Eurotransplant started', *Dialysis & Transplantation*, 1982, **11**: 520–5; H M A Schippers, 'The Eurotransplant story. Part 3: The first years of the Eurotransplant Foundation', *Dialysis & Transplantation*, 1982, **11**: 525–8; Bernard Cohen and Guido G Persijn, 'Twenty-five years of eurotransplant: a truly European collaboration', *Clinical Transplants*, 1992, 109–18; Ilias I N Doxiadis, *et al.*, 'It takes six to boogie: allocating cadaver kidneys in Eurotransplant', *Transplantation*, 2004, **77**: 615–17; Jean Dausset, 'L'association France-Transplant', *Nouvelle Presse Médicale*, 1972, **1**: 2247; *idem*, 'The HLA adventure', in P I Terasaki (ed.), *History of HLA: ten recollections*, Los Angeles, UCLA Tissue Typing Laboratory, 1990, pp. 1–17, on p. 8; Odile Burrus, 'France-Transplant', *Revue de l'Infirmière*, 1989, **7**: 59–63. See also Gauke Kootstra, 'The history of organ donation and sharing', in N S Hakim and V E Papalois (eds), *History of organ and cell transplantation*, London, Imperial College Press, 2003, pp. 55–63.

¹¹ Ingo Braun and Bernward Joerges, *How to recombine large technical systems: the case of European organ transplantation*, Berlin, Wissenschaftszentrum Berlin für Sozialforschung, 1993, pp. 27–9; Doxiadis, *et al.*, *op. cit.*, note 10 above; Lars U Lamm, *A report on the central organisation of transplantation in three European regions*, The Nordic Transplantation Committee and The Nordic Council of Ministers, 1988, p. 19.

¹² Bos, *op. cit.*, note 6 above, p. 77.

¹³ In this respect, Scandiatransplant may be pointing the way for the future of many organ exchange organizations, see Peter J Morris and Anthony P Monaco, 'HLA in the allocation of cadaver kidneys: a global perspective', *Transplantation*, 2004, **77**: 608.

¹⁴ Audun Flatmark, 'Scandiatransplant 20 years', *Tissue Antigens*, 1989, **34**: 30–4, on p. 33; Madsen, *et al.*, *op. cit.*, note 8 above, p. 621.

¹⁵ Leslie Brent, *A history of transplantation immunology*, San Diego, Academic Press, 1997, pp. 315–18. See also Nicholas L Tilney, *Transplant: from myth to reality*, New Haven, Yale University Press, 2003, pp. 229–43; Thomas E Starzl, *The puzzle people: memoirs of a transplant surgeon*, University of Pittsburgh Press, 1992, pp. 209–14.

¹⁶ Ingo Braun, Günter Feuerstein, and Claudia von Grote-Janzen, 'Organ-Technik. Technik und Wissenschaft im Organtransplantationswesen', *Soziale Welt*, 1991, **42**: 445–72, on p. 457; Braun and Joerges, *op. cit.*, note 11 above, p. 26.

¹⁷ Ilana Löwy, 'Tissue groups and cadaver kidney sharing: socio-cultural aspects of a medical controversy', *Int. J. Technol. Assess. Health Care*, 1986, **2**: 195–218, on p. 208.

¹⁸ Anne-Marie Moulin, *Le dernier langage de la médecine. Histoire de l'immunologie de Pasteur au Sida*, Paris, Presses Universitaires de France, 1991, pp. 217–18. See also Kootstra, op. cit., note 10 above, p. 62.

¹⁹ See the contributions in John V Pickstone (ed.), *Medical innovations in historical perspective*, Basingstoke, Macmillan, 1992; Ilana Löwy (ed.), *Medicine and change: historical and sociological studies of medical innovation*, Montrouge, John Libbey Eurotext, and Paris, INSERM, 1993; and Jennifer Stanton (ed.), *Innovations in health and medicine*, London, Routledge, 2002.

²⁰ John V Pickstone, 'Introduction', Pickstone, op. cit., note 19 above, pp. 1–16; Ilana Löwy, 'Introduction: Medicine and change', Löwy, op. cit., note 19 above, pp. 1–20; Jennifer Stanton, 'Introduction: On theory and practice', Stanton, op. cit., note 19 above, pp. 1–18.

²¹ Prottas, op. cit., note 3 above; Christian Hiesse, Fabienne Pessione, and Didier Houssin, 'The case to abandon human leukocyte antigen matching for kidney allocation: would it be wise to throw out the baby with the bathwater?', *Transplantation*, 2004, **77**: 623–6.

²² Jean Dausset, *Clin d'oeil à la vie. La grande aventure HLA*, Paris, Odile Jacob, 1998, pp. 178–9. See also Starzl, op. cit., note 15 above, pp. 118–24; Tilney, op. cit., note 15 above, pp. 138–9.

²³ Löwy, op. cit., note 17 above, p. 204.

²⁴ Moulin, op. cit., note 18 above, p. 223: "la cyclosporine a rejeté dans le passé historique la recherche de la compatibilité à tout prix".

²⁵ Ilana Löwy, 'Choix scientifiques et choix éthiques dans le traitement de la maladie rénale terminale', *Social Science Information/ Information sur les sciences sociales*, 1987, **26**: 577–605, on p. 592: "se débarrasser des contraintes propres à une distribution centralisée d'organes".

²⁶ Stanton, op. cit., note 20 above, p. 4.

²⁷ Löwy also conducted interviews with participants in the debate over tissue typing, but she seems to favour written sources for the kind of questions she examines, see op. cit., note 17 above, pp. 196–7.

²⁸ 'Med helikopter for at få ny nyre', *Jyllands-Posten*, 24 Nov. 1971, p. 1; 'Til hospital med helikopter', *Thisted Dagblad*, 24 Nov. 1971, p. 5; 'Dreng fra Ty blev fløjet til en ny nyre', *Aalborg Stiftstidende*, 24 Nov. 1971, p. 3. Arne W S Sørensen, interview by author, 14 Dec. 2005. Sørensen (b. 1926), a nephrologist, headed the dialysis department at Aalborg Sygehus Syd from 1970 to 1995.

²⁹ Moulin, op. cit., note 18 above, pp. 179–80.

³⁰ Tilney, op. cit., note 15 above, pp. 67–75, 129–32.

³¹ Brent, op. cit., note 15 above, pp. 310–15.

³² Risse, op. cit., note 9 above, p. 588.

³³ 'Hvordan det blev muligt at give syge en ny nyre', *Politiken*, 31 May 1964; Bundegaard, op. cit., note 6 above, pp. 24–30.

³⁴ Flemming Kissmeyer-Nielsen *et al.*, 'Nyretransplantation IV. Immunologiske aspekter', *Ugeskrift for Læger*, 1966, **128**: 757–69, on p. 766: "at anvendelsen af udvalgte donorer, der kun afviger fra recipienten for få leukocytantigeners vedkommende giver bedre kliniske resultater".

³⁵ Thomas Schlich, *Die Erfindung der Organtransplantation. Erfolg und Scheitern des chirurgischen Organersatzes (1880–1930)*, Frankfurt/Main, Campus, 1998; Brent, op. cit., note 15 above, pp. 56–63; Tilney, op. cit., note 15 above, pp. 36–43.

³⁶ Experiments quite similar to Simonsen's were carried out simultaneously by William Dempster in London, see Tilney, op. cit., note 15 above, pp. 109–12; Brent, op. cit., note 15 above, pp. 307, 348. See also Morten Simonsen, 'Immunologi', in J C Melchior, E Andreasen, K Brøchner-Mortensen, A Gjedde, V Møller-Christensen, and D Trolle (eds), *Københavns Universitet 1479–1979. Det lægevidenskabelige Fakultet*, University of Copenhagen, 1979, pp. 493–8, on pp. 496–7.

³⁷ Morten Simonsen, 'Historien om en tom etage', *Ugeskrift for Læger*, 1964, **126**: 1590–7; *idem*, op. cit., note 36 above, pp. 496–7.

³⁸ Paul I Terasaki, 'History of HLA: a personalized view', in Terasaki (ed.), op. cit., note 10 above, pp. 213–69, on pp. 220–1.

³⁹ Brent, op. cit., note 15 above, pp. 138–42; Tilney, op. cit., note 15 above, pp. 135–9. For "le psychodrame" of nomenclature, see Dausset, op. cit., note 22 above, pp. 104–6.

⁴⁰ Brent, op. cit., note 15 above, pp. 153–5.

⁴¹ Starzl, op. cit., note 15 above, p. 120.

⁴² Morten Simonsen, 'Strong transplantation antigens in man', *Lancet*, 1965, **i**: 415–18.

⁴³ *Ibid.*, p. 415. In Danish newspapers, Simonsen also foresaw that organ transplantations might soon become as simple and predictable as putting a new spare part in your car, see "Vi bliver som biler—alt kan skiftes ud", *Politiken*, 30 May 1965, pp. 1–2.

⁴⁴ Moulin, op. cit., note 18 above, pp. 213–14. See also Hiesse, Pessione, and Houssin, op. cit., note 21 above, p. 623, on "the dogma of HLA matching".

⁴⁵ Löwy, op. cit., note 25 above, p. 591.

⁴⁶ Arne Svejgaard, *et al.*, 'HL-A haplotypes frequencies in Denmark and Norway', *Tissue Antigens*, 1971, **1**: 184–95.

⁴⁷ Brent, op. cit., note 15 above, p. 138.

⁴⁸ Jon J van Rood, 'A proposal for international cooperation in organ transplantation: Eurotransplant', in E S Curtoni, P L Mattiuz, and R M Tosi (eds), *Histocompatibility testing 1967*, Copenhagen, Munksgaard, 1967, pp. 451–2.

⁴⁹ *Ibid.*, p. 451. See also *idem*, op. cit., note 10 above.

⁵⁰ van der Does, op. cit., note 10 above.

⁵¹ Flemming Kissmeyer-Nielsen and Arne Svejgaard, 'The early history of HLA', in Terasaki (ed.), op. cit. note 10 above, pp. 151–75.

⁵² Flemming Kissmeyer-Nielsen and K E Kjerbye, 'Lymphocytotoxic micro-technique purification of lymphocytes by flotation', in Curtoni, Mattiuz, and Tosi (eds), op. cit., note 48 above, pp. 381–3. On the importance of this technique for Eurotransplant, see Jon J van Rood, 'HLA and I', *Annu. Rev. Immunol.*, 1993, **11**: 1–28, on pp. 23–

⁵³ The Steno Institute Library, University of Aarhus (hereafter SIL), Love, betænkninger, korrespondancer, mødereferater vedrørende nyretransplantationer i Danmark 1953–1985, arkiv efter Jørn Hess Thaysen (hereafter JHT), Flemming Kissmeyer-Nielsen, 'Om udvælgelse af patienter til nyretransplantation' [1967].

⁵⁴ Flemming Kissmeyer-Nielsen, *Transplantation af menneskelige organer*, Copenhagen, Munksgaard, 1968, p. 66. SIL, JHT, Flemming Kissmeyer-Nielsen, 'Udveksling af organer', August 1968.

⁵⁵ Flemming Kissmeyer-Nielsen, 'Vævstypebestemmelser og transplantationer', *Nordisk Medicin*, 1970, **83**: 205–8; Björn L Lindström, 'Nordiskt transplantationssamarbete', *Nordisk Medicin*, 1970, **83**: 532–4. See also *idem*, 'The Scandiatransplant organization', *Annales Chirurgiae et Gynaecologiae Fenniae*, 1973, **62**: 175–7; *idem*, 'Scandiatransplant and the Nordic committee of experts on transplantation', *Scand. J. Urol. Nephrol. Suppl.*, 1981, **64**: 8–11; Flemming Kissmeyer-Nielsen, *Transplantation af menneskelige organer*, Copenhagen, FADL, 1979, p. 69; *idem*, 'Scandiatransplant – evolution and development', *Transplant. Proc.*, 1982, **14**: 205–8; Flatmark, op. cit., note 14 above.

⁵⁶ Flemming Kissmeyer-Nielsen, *et al.*, 'Scandiatransplant: preliminary report of a kidney exchange program', *Transplant. Proc.*, 1971, **3**: 1019–29, on p. 1022.

⁵⁷ Jørn Hess Thaysen, 'Indberetning nr. 2 til Sundhedsstyrelsen fra det under Sundhedsstyrelsen nedsatte udvalg vedrørende organisation af dialyse og nyretransplantationsbehandling i Danmark', *Fra Sundhedsstyrelsen*, 1973, **6**: 109–16, on p. 112.

⁵⁸ SIL, JHT, letter from Flemming Kissmeyer-Nielsen to the Committee on Dialysis and Transplantation, 14 Apr. 1970.

⁵⁹ See, for example, 'To nyrer fløjet fra USA til Danmark', *Ekstra Bladet*, 18 May 1977, p. 17.

⁶⁰ Flemming Kissmeyer-Nielsen and K E Kjerbye, 'Scandiatransplant: a visual matching system', P I Terasaki (ed.), *Histocompatibility testing 1970*, Copenhagen, Munksgaard, 1970, 639–41.

⁶¹ Melvin Madsen, 'Scandiatransplant: Nordisk samarbejde om organtransplantation', *Tidsskrift for danske sygehuse*, 1994, **70**: 18–20.

⁶² Braun and Joerges, op. cit., note 11 above.

⁶³ Flemming Kissmeyer-Nielsen, 'The HL-A system and renal transplantation', *Tissue Antigens*, 1971, **1**: 53–6, on p. 53; Flemming Kissmeyer-Nielsen and Egill Snorrason, *Den humane transplantations kunst. Dens udvikling og nuværende stade*, Copenhagen, Mølnlycke A/S, 1972, p. 81.

⁶⁴ Jørgen Mielche, 'Scandiatransplant: a matter of life and death', *Danish Journal*, 1970, **68**: 14–17.

⁶⁵ 'Nyre pr. fly fra Göteborg til Århuspatient', *Politiken*, 1 Mar. 1969, p. 1. 'Svensk nyre pr. fly til Danmark', *Aalborg Stiftstidende*, 16 Jan. 1970, p. 1.

⁶⁶ 'En utrolig læge-indsats gør det umulige muligt', *Politiken*, 27 Apr. 1969, p. 37. See also 'Verdens-centrum for bytte af nyrer', *Politiken*, 29 Apr. 1969, p. 4. On the plans for a global kidney exchange organization, see also Löwy, op. cit., note 17 above, p. 208.

⁶⁷ 'Nu haster det', *Politiken*, 29 Apr. 1969, p. 18.

⁶⁸ Mielche, op. cit., note 64 above; Flemming Kissmeyer-Nielsen, 'Humane transplantationer i relation til fremtidens medicin', *Medicinsk Forum*, 1969, **22**: 69–76; *idem*, 'Nyretransplantationer og vævsforlignighed', *Tidsskrift for sygeplejersker*, 1971, **71**: 52–57; *idem*, *Transplantation af menneskelige organer*, op. cit., note 55 above.

⁶⁹ On Kissmeyer-Nielsen's role as communicator of the importance of immunogenetics to young researchers and to the public, see Hans E Johnsen, *et al.*, 'Flemming Kissmeyer-Nielsen', *Ugeskrift for Læger*, 1991, **154**: 48.

⁷⁰ 'Betænkning afgivet af det under Sundhedsstyrelsen nedsatte udvalg vedrørende organisationen af behandling med dialyse ("kunstig nyre") og nyretransplantation i Danmark', *Fra Sundhedsstyrelsen*, 1969, **5**: 5–10, on p. 8: " regionalt samarbejde".

⁷¹ Moulin, op. cit., note 18 above, p. 216.

⁷² Kissmeyer-Nielsen and Snorrason, op. cit., note 63 above, p. 72: "Selv om andre forhold i visse tilfælde påvirker valg af recipient og donor, er det væsentlige dog vævstyperne hos recipient og donor, og det har derfor været naturligt, at det er blevet vævstypelaboratorierne i regionen, som er det centrale kommunikationsled, der finder frem til de bedst egnede recipienter og etablerer fornøden kontakt mellem donor- og recipientcentre."

⁷³ Kissmeyer-Nielsen and Snorrason, op. cit., note 63 above, p. 61. See also 'Betænkning', op. cit., note 70 above, p. 7.

⁷⁴ For the argument that the relevance of an object to scientific interest depends on the expectation that unanticipated observations may come from it, see Hans-Jörg Rheinberger, 'Cytoplasmic particles: the trajectory of a scientific object', in L Daston (ed.), *Biographies of scientific objects*, University of Chicago Press, 2000, pp. 270–94, on p. 273.

⁷⁵ *Beretning om de pr. 1. oktober oprettede Statens naturvidenskabelige Forskningsråd, Statens lægevidenskabelige Forskningsråd, Statens jordbrugs- og veterinærvidenskabelige Forskningsråd, Statens samfundsvidenskabelige Forskningsråd og Forskningsrådenes Centraludvalg i tiden 1. oktober 1968 til 31. marts 1970*, Forskningssekretariatet, 1971, pp. 65–7.

⁷⁶ Arne W S Sørensen, interview by author, 14 Dec. 2005.

⁷⁷ Löwy, op. cit., note 17 above; Moulin, op. cit., note 18 above, pp. 215–24; Tilney, op. cit., note 15 above, pp. 137–9; Brent, op. cit., note 15 above, pp. 156–9.

⁷⁸ Terasaki, op. cit., note 38 above, p. 232.

⁷⁹ Starzl, op. cit., note 15 above, p. 122; Brent, op. cit., note 15 above, p. 156.

⁸⁰ Starzl, op. cit., note 15 above, p. 122; *Transplantation today. Proceedings of the Third International Congress of the Transplantation Society. September 7–11, 1970, The Hague, The Netherlands*, New York, Grune & Stratton, 1971.

⁸¹ M R Mickey, *et al.*, 'Analysis of HL-A incompatibility in human renal transplants', *Tissue Antigens*, 1971, **1**: 57–67.

⁸² Kissmeyer-Nielsen, op. cit., note 63 above, p. 56.

⁸³ Mickey, *et al.*, op. cit., note 81 above, p. 57.

⁸⁴ Kissmeyer-Nielsen, op. cit., note 63 above, p. 55.

⁸⁵ *Ibid.*, p. 53 and 56. For other reactions to Terasaki's paper, see Löwy, *op. cit.*, note 17 above, p. 201.

⁸⁶ Melvin Madsen, interview by author, 13 Oct. 2005; Arne Svejgaard, interview by author, 10 May 2006. Melvin Madsen (1950–2006) specialized in nephrology but worked extensively within clinical immunology as well. He joined the tissue type laboratory at Århus Municipal Hospital in 1977 to do research on HLA-DR, and left to pursue a clinical career in 1982. He was the director of Scandiatransplant from 1992 to 1998. Arne Svejgaard (b. 1937) joined the Blood Bank at Århus Municipal Hospital in 1965 and did early work on histocompatibility testing with Flemming Kissmeyer-Nielsen. In 1971, Svejgaard established the tissue type laboratory at the National Hospital in Copenhagen, which he continues to head.

⁸⁷ Madsen, *et al.*, *op. cit.*, note 8 above, p. 621.

⁸⁸ Lars Erik Gelin and Audun Flatmark, 'Present and future aspects of kidney transplantation in Scandinavia', *Scand. J. Urol. Nephrol. Suppl.*, 1977, **42**: 213–14. SIL, JHT, Minutes from meeting of the Committee on Dialysis and Transplantation (hereafter CDT), 21 Nov. 1972.

⁸⁹ Madsen, *et al.*, *op. cit.*, note 8 above, p. 621.

⁹⁰ Kissmeyer-Nielsen, 'The HL-A system', *op. cit.*, note 63 above, pp. 55–6.

⁹¹ *Idem.*, 'Scandiatransplant – evolution and development', *op. cit.*, note 55 above.

⁹² Thaysen, *op. cit.*, note 57 above, p. 113: "en væsentligt mindre rolle".

⁹³ Dausset, *op. cit.*, note 22 above, pp. 178–9.

⁹⁴ Tilney, *op. cit.*, note 15 above, p. 138.

⁹⁵ Nora Machado, 'Incongruence and tension in complex organisations: the case of an organ transplantation system', *Human Systems Management*, 1996, **15**: 55–70, on pp. 64–5. On this tension, see also Prottas, *op. cit.*, note 3 above.

⁹⁶ A negative cross match, proving that the recipient was not already immunized towards the tissue type of the donor, was always required, see Tilney, *op. cit.*, note 15 above, p. 138.

⁹⁷ Löwy, *op. cit.*, note 17 above, p. 212; *idem.*, *op. cit.*, note 25 above, p. 591.

⁹⁸ Hiesse, Pessione, and Houssin, *op. cit.*, note 21 above, p. 623.

⁹⁹ Löwy, *op. cit.*, note 17 above, pp. 212–13.

¹⁰⁰ Ole Fjeldborg, 'Donorsituationen ved organtransplantationer', *Ugeskrift for Læger*, 1989, **151**: 2532–4, on p. 2534: "på andet end biologiske forhold".

¹⁰¹ Villy Posborg Petersen, *et al.*, 'Nyretransplantation I', *Ugeskrift for Læger*, 1966, **128**: 723–33, on pp. 724–5; Villy Posborg Petersen, *et al.*, 'Nyretransplantation II. Kirurgiske aspekter', *Ugeskrift for Læger*, 1966, **128**: 733–40, on pp. 734–5; Bundegaard, *op. cit.*, note 6 above, p. 26.

¹⁰² Kissmeyer-Nielsen, *et al.*, *op. cit.*, note 56 above, p. 1022.

¹⁰³ Legislation required the ventilator to be turned off and cardiac arrest to occur before the patient could be pronounced dead and the organs removed. Standard procedure in Danish transplant centres around 1970 was then

to re-apply mechanical or manual heart massage and perform the nephrectomy while circulation was maintained, cf. Richard Malmros, 'Om udvælgelse af donorer til transplantation', *Ugeskrift for Læger*, 1970, **132**: 400–2. On other steps taken by surgeons to limit warm ischaemia times before the introduction of brain death criteria, see Kootstra, op. cit., note 10 above, p. 59.

¹⁰⁴ Teddy Østerlin Koch, 'Ulovlige transplantationer', *Sygeplejersken*, 1993, **93**: 4–14. Bundegaard, op. cit., note 6 above, pp. 77–83. Brain death criteria were not introduced in Denmark until 1991.

¹⁰⁵ *Lov om udtagelse af menneskeligt væv* (Law concerning the excision of human tissue). SIL, JHT, CDT, 21 Nov. 1972.

¹⁰⁶ Jørgen Kvist Kristensen, interview by author, 15 May 2006. Kvist Kristensen (b. 1937) has been involved as a surgeon in donor nephrectomies and transplantations from the mid-1960s, first at the urological department at Gentofte Hospital and later at the National Hospital in Copenhagen, where he now heads the urological clinic.

¹⁰⁷ I have no detailed information on whether relatives were informed of the possibility that the organs they allowed to be donated might be sent to another hospital. Yet the exchange of kidneys between different hospitals may have influenced relatives in their decision to allow donation or not, and may consequently have made it more difficult for doctors and nurses involved to obtain consent.

¹⁰⁸ SIL, JHT, Scandiatransplant Necroreport, 1 Jan. 1969–31 Mar. 1972.

¹⁰⁹ SIL, JHT, Scandiatransplant Necroreport, 1 Jan. 1969–30 Sep. 1976.

¹¹⁰ SIL, JHT, Balance i nekronyreudveksling, 1 Jan. 1969–31 Dec. 1981.

¹¹¹ SIL, JHT, CDT, 8 Oct. 1981.

¹¹² Madsen, op. cit., note 8 above, p. 79.

¹¹³ Lars U Lamm, 'Activity and follow-up 1978', *Scand. J. Urol. Nephrol. Suppl.*, 1980, **54**: 6–10; *idem*, 'Scandiatransplant – 1980: activity and follow-up', *Scand. J. Urol. Nephrol. Suppl.*, 1981, **64**: 16–28. The last report actually included a table showing the imbalances between the centres, but this was not commented on in the text.

¹¹⁴ SIL, JHT, CDT, 8 Oct. 1981: "truer på alvorlig måde samarbejdet indenfor Skandiatransplant-organisationen". In France, surgeons and anaesthesiologists openly suggested a stronger local basis for kidney allocation, with immunologists like Jean Dausset strongly opposing a weakening of regional exchange, cf. René Küss, *et al.*, 'Les prélèvements de reins encore insuffisants: vers une régionalisation de la transplantation', *Bulletin de l'Académie Nationale de Médecine*, 1981, **165**: 381–94. For Küss, regionalization was opposed to national cooperation. On conflicts between transplant centres in France, see Ilana Löwy and Anne Marie Moulin, 'Du don à l'échange. Les institutions de transplantation', *Culture Technique*, 1985, **15**: 157–63, on p. 163.

¹¹⁵ Brent, op. cit., note 15 above, pp. 316–18; Tilney, op. cit., note 15 above, pp. 236–8.

¹¹⁶ Hans Dieperink, Niels Erik Frandsen, and Ejvind Kemp, 'Cyklosporin A. Lysere tider for organtransplantationer?', *Ugeskrift for Læger*, 1983, **145**: 2749–52; Vagn Andersen, 'Immunsuppression: nye udviklinger', *Ugeskrift for Læger*, 1983, **145**: 2775–6; Bundegaard, op. cit., note 6 above, p. 116; Søren Madsen, *et al.*, 'Kliniske resultater af immunsuppression med cyklosporin A ved nekronyretransplantation', *Ugeskrift for Læger*, 1984, **146**: 951–4.

¹¹⁷ Jørgen Ladefoged, 'Cyklosporin-A. Bedre resultater ved nyretransplantation', *Ugeskrift for Læger*, 1984, **146**:

1989–90, on p. 990: “anvendelse af cyklosporin vil også betyde, at den tidsrørende udveksling af nyre mellem de europæiske lande og indenfor Skandinavien, som hidtil har været nødvendig for at opnå optimalt væksttypeoverensstemmende nyre, vil aftage betydeligt”. Similar predictions of the organizational implications of the new immunosuppressant were voiced internationally, see Roy Yorke Calne, ‘Organ transplantation: from laboratory to clinic’, *Br. med. J.*, 1985, **291**: 1751–4; Moulin, op. cit., note 18 above, p. 223.

¹¹⁸ Ladefoged, op. cit., note 117 above, p. 990. A Danish trial of cyclosporine was not able to confirm this finding, see Madsen, *et al.*, op. cit., note 116 above, p. 953.

¹¹⁹ K R Harris, *et al.*, ‘Azathioprine and cyclosporin: different tissue matching criteria needed?’, *Lancet*, 1985, **326**: 802–4.

¹²⁰ G Lundgren, *et al.*, ‘HLA-matching and pretransplant blood transfusions in cadaveric renal transplantation: a changing picture with cyclosporin’, *Lancet*, 1986, **2**: 66–9, on p. 68.

¹²¹ Nils H Persson, F Pedersen, and Lars U Lamm, ‘Compliance with the rules of kidney exchange in Scandiatransplant’, *Transplant. Proc.*, 1992, **24**: 339.

¹²² SIL, JHT, CDT, 25 Mar. 1982.

¹²³ SIL, JHT, Notat om drøftelser og hovedkonklusioner fra et møde i Sundhedsstyrelsen den 29. maj 1984 vedrørende etablering af udrykningshold til nyreudtagning. See also Jes Søgaard, *Cost-effectiveness analyse af etablering af udrykningshold og ny immunsuppressiv behandling af nyretransplanterede patienter ved Cyclosporin A*, Odense Universitet, 1984.

¹²⁴ SIL, JHT, CDT, 6 Feb. 1986. Ole Fjeldborg, interview by author, 16 June 2006. Fjeldborg (b. 1928) was the surgeon who performed the first kidney transplantation in Denmark. He spent his entire career at Århus Municipal Hospital, performing most of the kidney transplantations there and also carrying out important work in the organization of kidney procurement in the local area. He retired in 1991.

¹²⁵ Lamm, op. cit., note 11 above. Lamm also shows how the need to deal with organs other than kidneys led Eurotransplant to develop new procedures. As a rule, hearts, lungs, and livers were exchanged through direct contact between local centres, while kidneys were still allocated by the central office.

¹²⁶ Braun, Feuerstein, and von Grote-Janzen, op. cit., note 16 above, pp. 457, 468.

¹²⁷ Moulin, op. cit., note 18 above, p. 223.

¹²⁸ Dausset, op. cit., note 22 above, p. 183: “la contrainte du HLA”.

¹²⁹ Gerhard Opelz, ‘The benefit of exchanging donor kidneys among transplant centers’, *N. Engl. J. Med.*, 1988, **318**: 1289–92.

¹³⁰ This is indeed the starting point in Susan Leigh Star and James R Griesemer, ‘Institutional ecology, “translations” and boundary objects: amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39’, *Soc. Stud. Sci.*, 1989, **19**: 387–420.

¹³¹ For a comparative study on the diffusion of medical technology with special attention to different levels of control, see Thomas Schlich, ‘Degrees of control: the spread of operative fracture treatment with metal implants: a comparative perspective on Switzerland, East Germany and the USA, 1950s–1990s’, in Stanton (ed.), op. cit., note 19 above, pp. 106–25.

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