



Feeding premature neonates: Kinship and species in translational neonatology



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ABSTRACT

Kinship, understood as biogenetic proximity, between a chosen animal model and a human patient counterpart, is considered essential to the process of 'translating' research from the experimental animal laboratory to the human clinic. In the Danish research centre, NEOMUNE, premature piglets are fed a novel milk diet (bovine colostrum) to model the effects of this new diet in premature infants. Our ethnographic fieldwork in an experimental pig laboratory and a neonatal intensive care unit (NICU) in 2013–2014 shows that regardless of biogenetics, daily practices of feeding, housing, and clinical care hold the potential for stimulating and eroding kinship relations between human and nonhuman actors. In the laboratory, piglets and researchers form 'interspecies-milk-kinships' that entail the intimate care crucial to keeping the compromised piglets alive during the experiments, thereby enhancing what the researchers refer to as the 'translatability' of the results. In the NICU, parents of premature infants likewise imagine a kind of interspecies kinship when presented with the option to supplement mother's own milk with bovine colostrum for the first weeks after birth. However, in this setting the NICU parents may perceive the animality of bovine colostrum, and the background information obtained in piglets, as a threat to the infants' connection to their biological parents as well as the larger human collective. Our study argues that the 'species flexibility' of premature beings profoundly shapes the translational processes in the field of neonatology research.

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1. Introduction

Evolutionary theory, supported by copious evidence, has established all living beings as related through common ancestors. Bolstered by the more recent genomic knowledge about the biogenetic proximity between humans and other animals, this evolutionary relatedness forms the foundation for the extensive use of nonhuman animals as models for human conditions in contemporary biomedical science. The so-called 'translation' of knowledge derived from animal experiments into clinical treatments of human patients is underpinned by a 'moral hierarchy' that positions human and nonhuman animals as biologically alike, yet morally different. Etymologically, translation means 'carrying

across' and refers to the linguistic process of transferring the meaning of a text from one language to another; a process that always involves a transformation of the original message. Similarly, translating by carrying across an intervention from animal laboratory to human clinic is a relational and transformative process that—despite detailed genomic knowledge and standardized scientific methods—can never be fully controlled. Clinical treatments tested in experimental animal models sometimes turn out to have adverse effects or no clinical benefit, in corresponding human patients (Denayer et al., 2014; McGonigle and Ruggeri, 2014). During the last twenty years the politically mandated field of 'translational research' has included investigations into the pathways to such 'translational failures' (Curry, 2008; Mankoff et al., 2004; Marincola, 2003). Biomedical researchers engaged in translational processes have argued that many translational failures can be ascribed to incomplete correlations between human and animal biology, disease mechanisms, and symptoms. As a result, much

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effort has been done to assure that animal models closely replicate the human disease phenotype and its genetic basis (Denayer et al., 2014). Yet, little is known about the daily housing, feeding (Landecker, 2013), and caring practices (Friese, 2013) whereby biomedical and clinical researchers relate laboratory animals and human patients in order to facilitate bench-to-bedside translation.

In the present analysis, we explore how relatedness between human and animal actors is integrated in the daily practices in translational research. Through ethnographic fieldwork, we follow the work of animal and clinical researchers in NEOMUNE—a centre for translational research committed to identifying the optimal diet for newborn premature infants with no or limited access to mother's own milk. In stimulating the immune system, mother's first milk—the colostrum—facilitates the neonatal transition from the sterile fetal life to the microbe-rich environment ex-utero, which all mammals have to adapt to at birth. The researchers in NEOMUNE use piglets as their primary model for premature newborn infants that due to the postnatal bacterial colonization are at risk of many diseases, including the life-threatening gut disease necrotizing enterocolitis (NEC). The experimental studies in piglets show that *bovine* colostrum, protects against NEC equally to human donor milk compared to infant formula and is superior to both human donor milk and infant formula in stimulating growth, gut immunity, and digestive functions (Jensen et al., 2013; Rasmussen et al., 2016; Shen et al., 2015). These experiments have paved the way for a clinical pilot study, where bovine colostrum is for the first time given to premature infants in their first days of life if mother's colostrum is absent or limited.

As we followed the researchers in the pig laboratory, and the clinicians and parents in the NICU, we learned that their care practices were largely structured by feeding routines. In observing the preparation of milk, the serving of meals, and the monitoring of how well the premature piglet or infant responded to the food, we experienced that practices of forging and imagining relationships between animals (piglets, cows) and humans (researchers, parents, infants) were woven into the processes of translating knowledge from the laboratory to the clinic. Relatedness between the species was not only a matter of biogenetic proximity between piglets and infants, but also of daily social practices between various human and animal actors.

To unravel these practices of relatedness in translational neonatology research, we take analytical inspiration from two connected bodies of scholarship. Our point of departure is the work of feminist anthropologists who have moved beyond the traditional Western understandings of kinship as defined and fixed by biological consanguinity (Carsten, 1995; Franklin and Mckinnon, 2001; Haraway, 1997; Hird, 2004). These scholars discuss kinship as a practice in which individuals mark and transgress the boundaries of the biosocial categories of race, gender, kin, and species (Franklin and Mckinnon, 2001). Extending the insights from feminist kinship studies, we draw on multispecies scholars who argue that animals are a part of society rather than just a symbol of it (Kirksey and Helmreich, 2010). Emphasizing the dynamic relationship between humans and animals (Candea, 2010; Govindrajana, 2015; Haraway, 2008) this body of research calls for studying species as a “situated practice” of transforming divisions and connections (Yates-Doerr, 2015:309).

What guides our analysis in the following is not so much where the boundaries between species are drawn. Rather, inspired by Emily Yates-Doerr's ethnography on eating practices in Highland Guatemala, we explore “what a relation or a boundary can be taken to mean” (Yates-Doerr, 2015:311). Our article thus elucidates how translation between species is connected to the ways relatedness between humans and animals is enacted and imagined in the everyday life of translational neonatology research in Denmark.

We begin with a short methodological section describing our ethnographic approach and the way in which we are affiliated with the NEOMUNE Centre. In the following analysis, we investigate the kinship relations that are stimulated and eroded in feeding premature neonates bovine colostrum in the pig laboratory and in the human NICU. We suggest that in neonatology research, where piglet models and infant patients are at the margins of life, their prematurity may enable intimate ‘interspecies-milk-kinships’. In the animal laboratory, this ‘species flexibility’ creates a space of possibility where bovine colostrum is seen as the best diet for premature piglets, and where human researchers care for the research animals they feed as if they were their own children. In the NICU, parents also evoke a kind of ‘interspecies-milk-kinship’, but in this setting the animal origin of the bovine colostrum as well as the information from the researched piglets seem to imply something dangerous that threatens the infants' attachment, not only to their parents but also to the human collective. Attending to the species flexibility of piglets and infants we draw out the different kinds and stakes of flexibility at play in the relationship between the animal laboratory and the human NICU. We conclude that awareness regarding the permeability of boundaries between human and animal bodies and their bodily substances may not only prove useful when unraveling translational failures, but also inform us about operations of science and how we make sense of ourselves in relation to other life forms.

2. Study and methods

In December 2012 the Danish Council for Strategic Research and collaborating industries granted 60 million DKK to the Danish research initiative NEOMUNE Centre. In NEOMUNE, international partners from universities, hospitals and the milk industry collaborate to investigate how early nutrition affects the development of the immature gut, immune system and brain in compromised newborns (mainly focusing on premature infants). Ultimately, the stated goal is to develop better clinical guidelines and diet products to support health and survival of these newborn infants. The objectives lead to execution of observational and clinical studies in infants based upon insights from experimental animal studies. NEOMUNE is directed by the leading professor at the experimental piglet laboratory. His wish for a close collaborative relationship with neonatologists in the NICU at Copenhagen University Hospital has been a driving force behind the initiation of the centre. NEOMUNE includes a small social science work group, which focuses specifically on translational processes between experimental and clinical research in the centre. The work presented in this article is based mainly on the work of the first author, Mie S. Dam, carrying out her Ph.D. studies within the social science workgroup. The second author, Sandra M. Juhl, is a medical doctor and manages the clinical colostrum study as a part of her Ph.D. studies. The third author, Per T. Sangild, is the leader of NEOMUNE and member of the social science workgroup. The last author, Mette N. Svendsen, is head of the social science workgroup and supervisor of the first author.

Between January 2013 and June 2014, the first author carried out ethnographic fieldwork related to different NEOMUNE activities. This fieldwork included six weeks of participant observation in the preterm pig laboratory at the University of Copenhagen conducted between March and July 2013 and again in November 2013. She followed four experimental studies during which piglets were used to test the effects of bovine colostrum. Concurrently, Mie interviewed researchers and technicians involved in the pig studies (7 interviews) and Mie and Mette interviewed the NEOMUNE steering group members (7 interviews). All interviews were semi-structured and took place in offices at the floor above the pig

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