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Chapter 5
The Possession of Kuru: Medical Science and Biocolonial Exchange

Warwick Anderson

"Naturally, everyone would like to get their hands on kuru brains," wrote D. Carleton Gajdusek in 1957.[1] A young medical scientist, Gajdusek was writing from his bush laboratory in the eastern highlands of New Guinea, and he had in mind the competition among pathologists in Melbourne, Australia, and Bethesda, Maryland, for the valuable specimens. But he may also have considered his own recent transactions with the Fore people, afflicted with what he thought was the disease of kuru, and on whose hospitality he was then relying. Blood and brains, the germinal objects of his field research, were richly entangled in local community relations and global scientific networks; they could convey one meaning to the Fore, another to Gajdusek, and yet another to laboratory workers in Australia and the United States. These objects could be exchanged as gifts or commodities in different circumstances, or on the same occasion the different parties might confuse gift exchange with commodity transaction. At times, the scientist would try to obtain goods through barter, or even to appropriate them; and, then again, he might find that what he wanted was out of circulation altogether. In the field, Gajdusek had become enmeshed in a complex and fragile web of relationships with the Fore in order to acquire specimens that, through further exchanges with senior colleagues, might yet make his scientific reputation.

In this essay I will examine a variety of transactions between the Fore and the anthropological and medical fieldworkers who first ventured into the highlands in the 1950s. My concern here is not with the "kuru story" itself, nor with an account of who got it right, for the rapid accumulation of kuru knowledge has already been well charted.[2] My question is not *what* did people learn about the Fore and kuru, but *how* did they learn it-and how, indeed, did they make such knowledge both valuable and identifiably their own. Accordingly, the true meaning of kuru-whether disease, sorcery, adjustment disorder, a slow virus, a people, or a territory-should ultimately remain as ambiguous or opaque to the readers of this essay as it was to everyone involved in kuru transactions. How does anyone make sense of a phenomenon as protean as kuru? How does one gain credit for knowing at the same time as one circulates that knowledge? How might Gajdusek, or anyone else, come to possess kuru?

I hope to make a place in this essay for exchanges between the history of science, economic anthropology, and post-colonial studies.[3] In studying the many exchange regimes that developed around kuru-the transactions between the Fore and other local groups, between

[1] D. Carleton Gajdusek to J. E. Smadel, 25 August 1957, in Farquhar and Gajdusek (1981, 121).

[2] For recent accounts of the investigations of kuru, see Nelson (1996); Rhodes (1997).

[3] This work is thus part of a more general effort to make connections between anthropology and science studies. Previously, this effort has been manifest in the introduction of ethnographic methods, as in the pioneering work by Bruno Latour and Steve Woolgar ([1979] 1986); or it has found expression in the increasing use of cultural analysis and a focus on identity formation. For recent surveys, see Hess and Layne (1992); Hess (1995); Franklin (1995); Layne (1998).

medical scientists and research subjects, between anthropologists and informants, between groups of scientists and anthropologists-it should be possible to provide an outline of the material culture of late colonial, postwar scientific exchange. I would like to take kuru brains, with related objects, and use them to think more generally about the creation of value and the circulation of goods in global science. The project is thus aligned with, and yet deviating from, recent work on the commodification of body parts and their insertion into a global medical market.[4] To mobilize kuru objects in a scientific exchange regime was not simply to commodify them. Instead, the material alienated from the Fore became, for a time, part of the inalienable wealth of Gajdusek in his dealings with scientific colleagues. As we shall see, the demands of scientific authorship in this case impeded a conventional process of commodification.[5]

The complicated misrecognition of exchange relations that occurs repeatedly in kuru research suggests that we should avoid a slavish adherence to transactional typologies. The general distinction between a gift economy and commodity economy can be heuristically useful, but such categories are not easily discerned in a cross-cultural setting, a situation where no one could agree on what was a gift and what was a commodity, what was available for barter or appropriation and what was out of circulation.[6] Typically, in the exchange of gifts, objects have a personal value; they are never completely alienated from those who made them or gave them. Gift exchange is intended to create a sense of social obligation, so it is important that the giver gives wisely and the recipient recognizes the character of the transaction. A gift is always to some degree attached to its maker or giver, and it carries with it a social debt, implying a relationship of reciprocity (even if an unbalanced one). But in more commodified transactions, whether local or global, the relationships between things and their transactors are more independent, incurring little or no social debt. In treating something as a commodity, the residual interests of other people can be denied, and the object appropriated.[7] It is tempting, then, to ask whether a "kuru brain" was a gift or a commodity in the exchange relations of late colonial science. If a gift, was the object inalienable from the Fore or from Gajdusek? If a commodity, what was its price? Such questions are tantalizing, but kuru exchanges were never so simple as to provide easy answers.

Since kuru research initially occurred within the disciplines of a colonial order, the exchange regime can appear speciously transparent and one-sided. When events take place in a region that most historians of science would regard as the colonial periphery, it may be that the inequalities and asymmetries of the transactional order, the differences in estimates of value, and the misunderstandings of intention are all fixed more easily in the mind, perhaps to the extent that we cannot readily identify any Fore involvement or agency in kuru

[4]See Radin (1996). For disputed and resisted commodification of body parts and fluids, see Titmuss (1970); Golden (1996).

[5]I outline the more recent trend to commodify science in the conclusion. See Nelkin (1984); Gold (1996) and the symposium on "Legal Disputes over Body Tissue," edited by Nelkin and Andrews (1999).

[6]The distinction is made most clearly in Gregory (1982) and Carrier (1995). I agree with Nicholas Thomas that the analytic distinction of gift and commodity is worth preserving, so long as this does not simply collapse into a distinction between indigenous and Western societies, and does not obscure "the uneven entanglement of local and global power relations on colonial peripheries, particularly as these have been manifested as capacities to define and appropriate the meanings of material things." See Thomas (1991, xi). On the cultural constitution of objects in general, see Appadurai (1986) and Parry and Bloch (1989).

[7]On gift exchange, see Mauss ([1925] 1970); Malinowski (1922); Sahlins (1987); Strathern (1988); Weiner (1985, 1992); Cheal (1988); Godelier (1999). Of course much of this work derives from studies of New Guinea societies, so it seems especially appropriate that it is reapplied to study scientific exchanges in New Guinea.

research. It may seem that their possessions were simply whisked away from them. And yet, as many historians of colonial science-informed by anthropological studies-have recently demonstrated, colonial order often disguised an unequal and disordered reciprocity.[8] In such out-of-the-way cases, our failure to recognize the local entanglements of scientific objects, and the features of reciprocity in their exchange, may simply derive from our convenient reliance on the estimates of value offered by scientists returning from a distant and mysterious field. Perhaps the most distinctively colonial feature of colonial science is that its history can *seem* purely a matter of extraction and appropriation, an insertion of previously valueless objects into a scientific exchange regime with the messy influences of local sociality and politics erased. But the complex transactions involved in kuru fieldwork, and in the later global circulation of scientific valuables, confirm that explanations framed in terms of dominance and subordination will often (but not always) misconstrue local meanings and global power relations.

Historians and sociologists of science have generally hesitated to draw on economic anthropology to explain modern scientific exchange in North America and Europe (or anywhere else for that matter). But in a pioneering analysis, Warren Hagstrom, a functionalist sociologist of science, observed that in return for the gift of research papers, the scientist receives recognition from the scientific community. This exchange seemed to him to create "particularistic obligations," to reduce the "rationality of economic action," and thus to ensure that the scientist conforms to normative behavior. In accordance with a functionalist tradition, Hagstrom therefore subordinated his description of a gift relationship between individual scientists and the scientific community to an explanation of the reproduction of scientific norms. But he wondered why "this frequently inefficient and irrational form of control" persisted in modern science. Why should gift giving be important in science "when it is essentially obsolete as a form of exchange in most other areas of modern life, especially the most distinctly 'civilized' areas?"[9] A decade or more later, Bruno Latour and Steve Woolgar echoed the same question. They protested against Hagstrom's recourse to "the archaic system of gift exchange" to explain exchange relations in science. In their study of the production of facts in a neuroendocrinology laboratory, Latour and Woolgar claimed instead that "the constant investment and transformation of credibility taking place in the laboratory mirrored economic operations typical of modem capitalism." But despite their attempt to commodify the relations they observed, Latour and Woolgar provided ample evidence for the inalienability of things in the laboratory, and the resilience of bonds between the value of objects and social status.[10] They were in fact describing a gift relationship, but one with elements of calculation and competition, similar to the strategic use of reciprocity that Pierre Bourdieu had identified among the Kabyle.[11] It is unfortunate that Hagstrom's linking of gift exchange to normative behavior impelled a generation of sociologists of science, most of them wary of functionalist pieties, to tum away from economic anthropology.

More recently, a few historians and sociologists of science have again come to use economic terms to explain local, and even global, research exchanges. In his innovative study of the work of the Morgan group on *Drosophila* genetics, Robert Kohler describes a "moral economy" of scientists, distributed within the laboratory-where credit and rewards for pro-

[8] See Arnold (1993) and Prakash (1999).
[9] Hagstrom ([1965] 1982, 28).
[10] Latour and Woolgar ([1979] 1986, 203–204).
[11] Bourdieu ([1972] 1997).

ductivity are distributed? and in the wider sphere of exchange between laboratories.[12] Mario Biagioli, informed by the work of Hagstrom and Bourdieu, describes gift exchange in the early modem Italian states as a "medium through which patronage relationships were articulated and maintained." A cycle of debt developed between client and patron, a reciprocal disequilibrium, which led Galileo industriously to try "to produce or to discover things that could be used as gifts for his patrons."[13] Although Biagioli restricts his account of early modern scientific transactions to the traffic between patron and client, and though on occasion he too seems to imply that this exchange regime is archaic, his economic approach might usefully be taken in the analysis of more modern scientific transactions.[14]

There are, of course, other ways to try to understand scientific exchange. In his celebrated study of the practices of experimentation, instrumentation, and theory in modern physics, Peter Galison recognizes the need for an analysis of transactions that occur in the "trading zone" between scientific "subcultures." However, his analytic framework is predominantly linguistic or discursive in style, an expansion "of the notion of language to include the disposition of laboratory objects." Galison thus sees the patterning of exchanges of material objects in ethnolinguistic terms, as the construing of "wordless pidgins" and "wordless creoles." In order to make an important epistemological argument Galison tries to "expand the notion of contact languages to include structural symbolic systems that would not normally be included within the domain of 'natural' language."[15] Still, something of the materiality of exchange, and its role in shaping the identity of transactors, seems to get lost when linguistic analysis substitutes for political economy. I hope that the study of kuru will confirm that one can explain a complex local and global patterning of modern exchange relations without resorting to such tempting linguistic models.

It is obvious that no essay can convey torment and suffering—not that of the Fore, not anyone's. Economic anthropology and the history of science certainly are not geared to such a task. But at least they might help us to understand how suffering was once—and perhaps still is—circulated as science.

5.1 Locating Kuru

The Fore people live in the eastern highlands of Papua New Guinea. During the 1950s there were more than ten thousand Fore living in stockaded villages, looking after their pigs and tending their gardens of sweet potato. The men kept to themselves in the men's house, while all the women and children occupied separate dwellings. The villages were controlled by "big men" and warfare was common: indeed, it was perhaps the major cause of death among males. Although a patrol post had been established at Okapa, for most of the 1950s large parts of the region were still not under government control. The Australian territories of Papua and New Guinea were administered from distant Port Moresby, and the authorities had difficulties enough just covering the controlled areas. The Department of Public Health, under Dr. John Gunther, had expanded enormously after the war in the Pacific, but in 1957 there were still no more than sixty-seven doctors, mostly European refugees, who were expected to prevent and treat the diseases of the whole population of the archipelago. Malaria,

[12] Kohler (1994). His use of the term "moral economy" derives from Thompson (1971).
[13] Biagioli (1993, 36–48). See also Findlen (1991).
[14] See also the important work of Oudshoom (1990); Clarke (1995); Lindee (1998).
[15] Galison (1997, 51–835).

tuberculosis, diarrheal diseases, pneumonia, and malnutrition were common; conditions that could have been prevented or treated still took the lives of thousands each year.[16]

In the 1930s, the Fore observed the first airplane flying overhead; during the war some Australians slipped out through Fore territory, and at least three combat planes crashed there; later a few hardy prospectors passed quickly over the land. Australian patrol officers began to make contact with the Fore in the late 1940s. The first administrative patrol was threatened with arrows at one point, but otherwise the local inhabitants greeted it warmly, if apprehensively. On this first occasion, and sometimes on later excursions, the patrol officers took the more daring of the Fore men back with them to learn some Tok Pisin and see what the government was doing; later, these officers might also appoint village officials and set up police posts; and always they told the people to build roads and stop fighting. The patrol officers found that many of the people would insist on them visiting their villages, where they were given great amounts of food and urged to stay. Gradually new crops were introduced to the region, and the Fore began eating potatoes and tomatoes; they also began to cultivate coffee; and many of them took to wearing laplaps.[17] The exchanges of food and other goods occurred with increasing frequency, and over the next twenty years few outsiders failed to comment on the region's profound social transformation and the remarkable adaptability of the Fore.

Most of the patrols included medical orderlies, whose reports noted widespread ill-health, usually the result of wounds or conditions such as yaws. Epidemics of measles, mumps, and whooping cough preceded contact with outsiders. In response to these (and other) afflictions, sorcery accusations abounded and officers frequently heard of sorcery deaths. Arthur Carey, patrolling the east Fore in 1950, saw some of the effects of this sorcery in the form of a few cases of intense shaking with no fever. The shaking or trembling was called *guria* or kuru, and Carey was told that those afflicted would die quickly.[18] In August 1953, patrol officer J. McArthur confirmed Carey's findings:

> Nearing one of the dwellings I observed a small girl sitting down beside a fire. She was shivering violently and her head was jerking spasmodically from side to side. I was told that she was a victim of sorcery and would continue thus, shivering and unable to eat, until death claimed her within a few weeks.[19]

For the government officers kuru was, as Hank Nelson puts it, "an impediment to orderly administration rather than a disease."[20] And they already had plenty of other impediments to administration, and plenty of diseases for that matter, with which to contend.

The first anthropologists visited the Fore between 1951 and 1953. Ronald and Catherine Berndt had trained in Sydney, and their interest in studying the destructive effects of violence drew them to the eastern highlands. They had wanted to restrict their fieldwork to Aboriginal Australia, but A. P. Elkin, the professor of anthropology at Sydney, advised

[16]Nelson (1996); Mathews (1971); Denoon (1989). More generally, see Bishop and Nelson (1973) and Nelson (1982). On the Fore, see Berndt (1962b) and Glasse and Lindenbaum (1971).
[17]Nelson (1996). In the early 1960s the Australian colonial authorities began actively to convert the local exchange regime to a cash economy.
[18]Cited in Nelson (1996, 188).
[19]J. McArthur, Okapa patrol report, quoted in Lindenbaum (1979, 9).
[20]Nelson (1996, 189).

them to undertake at least one period of fieldwork in a different culture.[21] Ronald Berndt discussed possible New Guinea field sites with E. W. P. Chinnery and K. E. "Mick" Read, and he read Leahy's *The Land that Time Forgot* and Hides' *Through Wildest Papua*, before deciding on the eastern highlands.[22] The Berndts flew into Lae, and then went on to Kainantu in late 1951. When they left Kainantu for their field site, Catherine Berndt, who had sprained her ankle, rode a horse ahead of a long line of porters: "An excited mob accompanied us and our carriers, grabbing at us and pulling us back, making sucking and hissing sounds, shouting and calling to us, greeting us with their welcoming words 'I eat you.' "[23] Still later, Ronald Berndt recalled that:

> Our progress consisted of scenes reminiscent in some ways from those of King Solomon's Mines. The terrain was rough and at times very steep; the track, often edged with jungle, was slippery and narrow. A long line of carriers (more than we wanted), with our boxes lashed to poles, stretched out further than I could see. At the head was Catherine, mounted on her horse and surrounded by plumed and decorated men with their bows and arrows, singing as they walked and danced along.[24]

The Berndts stopped at Maira, in Kogu, where a large house had been built for them, as though (so it seemed to them) they were the returning spirits of local ancestors. "Garden produce was heaped before us, pigs were killed, and dancing and singing went on until well after dark. … We were viewed as returning spirits of the dead who had forgotten the tongue of our fathers and wanted to relearn it"[25] The house was ready for the goods the Berndts were carrying.

During the first period of fieldwork, from November 1951 until May 1952, the Berndts focused on culture contact, violence, and issues of personal responsibility and social control. From their own observations and what the local inhabitants told them, the Berndts attempted to put together a coherent account of the local society, its kinship and language groupings, its feelings of insecurity, recourse to warfare, and patterns of commerce. Maira proved a difficult field site. "At times we did not like these people, but just as frequently we did; and this fluctuation is mirrored to some extent in their own response to life—aggressive and violent excitement contrasted with extreme and sometimes tearful sentimentality." The Berndts were unsure of their status and their role in the local exchange regime:

> We were spirits and aliens, on the one hand identified with themselves, on the other viewed as strangers there for their convenience. We were assumed to be capricious and undependable, possessed of "power" such as ghosts or malignant spirits have, to do them harm if we felt so disposed-beings who had to be propitiated by lengthy recordings and descriptions and explanations. This led to a certain strain in interpersonal relations and served as a basis for some misunderstandings.

[21] Interview with Catherine Berndt, August 1992; Berndt (1992) and Berndt (1992). Although the Berndts had been studying Aboriginal groups since the 1940s, they intended to use the New Guinea material for their PhD dissertations, supervised by Raymond Firth at the London School of Economics. But the Berndts were never fully satisfied with their fieldwork in New Guinea and later worked only in Australia.
[22] Leahy and Crain (1937); Hides (1935).
[23] Berndt (1962b, viii).
[24] Berndt (1992, 72).
[25] Berndt (1962b, viii–ix).

Initially, the Berndts tried to barter for information by handing out matches, shells, and salt. Later the intruders realized that they had become entangled in some sort of gift relationship-at the end of fieldwork, "gifts were distributed on the same basis"-but it seems that the Fore did not believe that their interlocutors gave well in this transaction. A story circulated among the Fore that the anthropologists were "going to round them up and take them to jail, first cutting off their hands and even their heads!"[26] Already, the Fore were on the alert for white headhunters.

The Berndts believed that the suspicion and social disruption that they observed were, in part, manifestations of the local effort to adjust socially and psychologically to European contact. The reactions of the Usurufa, Fore, and other local language groups appeared to follow the pattern set by other peoples in New Guinea.[27] According to the Berndts, the people of the area were convinced that the spirits of their ancestors had sent a cargo of European goods, but that Europeans either had misappropriated them or were unpredictable ancestors who refused to recognize their obligation to distribute these valuables. (The local attitudes toward Europeans seemed ambivalent.) In order to obtain their possessions the Fore and others engaged in magical performances related to spirit possession, hoping to cause planes to bring the materials directly to them. The Berndts thus associated the local behavior with a classic issue in functionalist anthropology, once known as the "Vailala madness" but more commonly described as a "cargo cult" or "adjustment movement."[28] In so doing, they emphasized the emotional insecurity of the Fore, their awe and fear of the coming of the white man, and their expectations of material benefit.

The cargo movement was fed by resentment and frustration. A "zona wind," or ghost wind, was thought to blow across the land, bringing with it the spirits of the dead. When the zona blew, many of the people became possessed by the spirit within it and began to tremble and shake. The Berndts reported that this shaking was called "guria," and was "similar to (but distinguished from) a shaking sickness caused through sorcery."[29] Collective paroxysms had also been reported in other adjustment movements, and the Berndts could cite a number of examples in the anthropological literature of apparent "contagions" of involuntary reeling, staggering, and violent shaking. Once possessed by the spirit of the zona, the people set to work to build a large house and fill it with stones, wood and leaves, objects which would magically be transformed into paper, rifles, and knives. After killing a pig, the Fore would anoint the objects and the house with blood and await the transformation of their holdings. These cargo movements were still springing up sporadically across the region when the Berndts were conducting their fieldwork, but the anthropologists had arrived at a time when government officials and missionaries were able to break up such movements as they arose. The Berndts reported that when two missionaries visited a nearby village, "the natives were told to bury all human bones and skulls, which had been placed in the village clearing as a result of the cold wind and shivering accompanying the initial manifestation of

[26]Berndt (1962b, vii, ix, xiii, ix).

[27]Their first field site was in Usurufa territory, but in their earlier publications the Berndts tended to generalize their findings to cover adjacent language groups, such as the Fore. (Although four language groups were defined, they expressed a "common culture with local variations," Berndt (1962b, 8).) Their later fieldwork was conducted among the Fore and it seemed to confirm their earlier generalizations from the Usurufa observations. The language groups do, however, become more clearly differentiated in later publications.

[28]Berndt (1952, 42–65, 137–58, 202–34). For a later treatment of the same topic, see Berndt (1962a).

[29]Berndt (1952, 57). On guria as, more generally, "a culturally-determined expression of a variety of excitatory themes including physical illness and interpersonal and ecological tensions," see Hoskin, Kiloh, and Cawte (1969).

the cargo movement."[30] But if this policy had suppressed the collective manifestations, it certainly did not eliminate all cases of guria.

In 1952 and 1953 the Berndts spent a further period in the field, this time further into Fore territory. They were now able to differentiate more clearly between collective and individualized spasmodic reactions, and they began to put more weight on alleged sorcery as a cause of some of the psychosomatic manifestations. Although possession by the spirits of the zona still seemed an important cause of guria, the Berndts reported another form of shaking which involved partial paralysis and lack of muscular control, and frequently led to death. According to Ronald Berndt, there were "involuntary twitchings, a feeling of abnormal coldness, dilation of the eyes which appeared to be glazed, and lack of control over the limbs."[31] The Fore attributed individual cases to "guzigli" sorcery, and the Berndts thought that these sorcery accusations were yet another manifestation of anxieties attendant on culture contact.[32] Sorcery might be used in an attempt to resolve increasing internal and external conflicts, yet at the same time it served to exacerbate these conflicts even further. On the whole, the Berndts were prepared to explain the strange behavior of many of the Fore as a form of hysteria, a psychosomatic response to recent stresses, but Catherine Berndt did recall trying, unsuccessfully, to get the medical authorities involved. She had spoken to Margaret Mead about kuru and Mead suggested that she should get the doctors in.[33] Even so, the Berndts would continue to urge later investigators not to rule out a psychosomatic cause. As late as 1959, Ronald Berndt was still trying to describe the widespread emotional insecurity in the Fore region, the sense of distrust and suspicion, the common allegations of sorcery, and the universal belief in sorcery poison. "Social or cultural events," he wrote, "may have far-reaching effects on the human organism itself, even to the extent of interfering so drastically with it that it ceases to function."[34]

Surprisingly, the Berndts rarely mentioned cannibalism in their early papers, but during the 1960s, when they were completing the publication of their fieldwork, they seemed, like so many other scholars of the time, to become fascinated by the subject. Patrol officers had occasionally reported stories of endocannibalism among the Fore, and the Berndts confirmed, almost in passing, that the Fore, especially the women, would engage in the ritual consumption of a loved one after death. Generally it was a relative who was "cooked and eaten almost immediately after death [although] a favored method was first to bury the corpse, and then to exhume it after a few days when the flesh was sufficiently decomposed to be tasty."[35] At first, cannibalism was little more than an interesting excursion from the Berndts' main themes. But by the time Ronald Berndt came to write *Excess and Restraint* he was prepared to expatiate on such unusual funerary practices. "Human flesh," he wrote, "is not eaten to absorb the 'power' or strength of the deceased, nor do men consider that female flesh will have a weakening effect on them." Rather, it was thought that the dead liked to be eaten, and that their wishes should be respected. Most Fore believed that the crops would

[30] Berndt (1952, 65).
[31] Berndt (1954, 206). For another account of the reaction to contact, see Berndt (1953).
[32] Berndt (1962b, 218–9). Berndt noted that "the attacks are described as becoming more frequent and more intense, with death as an inevitable climax," p. 218.
[33] Interview with Catherine Berndt, August 1992.
[34] Berndt (1958, 25).
[35] Berndt (1952, 44). Catherine Berndt later claimed that Ronald had been offered some partly cooked flesh from a kuru victim, but was too squeamish to eat it.

increase with the eating of their loved ones.[36] Although Berndt, like most other analysts of cannibalism, never witnessed the feast, he accepted his informants' statements on the matter, even their more bizarre tales linking the consumption of the corpse with necrophilia. Walter Arens later condemned Berndt's "lengthy, titillating descriptions of often-combined cannibalistic and sexual acts," but he went too far when he suggested that *Excess and Restraint* was "aptly titled only in the sense that on intellectual grounds it displays too much of the former and too little of the latter."[37]

By 1957, kuru had been identified in a few government reports and anthropological treatises, but it remained a predominantly local phenomenon, entangled in Fore social life and mundane political arrangements. If the place where kuru occurred was known to the world at all, it was as the "Fore region." But before long it would be better known as the "kuru region." How did this change take place?

5.2 Mobilizing Kuru

The Fore believed that a sorcery poison caused kuru; the Berndts suggested that the stresses of culture contact might produce emotional insecurity and psychosomatic disorders, perhaps even something as lethal as kuru; but Dr. Vincent Zigas, the medical officer at Kainantu, suspected that the kuru which afflicted increasing numbers of the Fore was a manifestation of encephalitis, an inflammation of the brain. Initially, Zigas had endorsed the Berndts' idea that kuru was a hysterical reaction, but he changed his mind after spending twenty days with the Fore in 1956, and wrote to Gunther that year to request further medical investigation of the outbreak.[38] Gunther advised Zigas to cooperate with Dr. Gray Anderson from the Walter and Eliza Hall Institute in Melbourne on further studies of kuru. Anderson had been investigating other forms of encephalitis in New Guinea, and both Gunther and Sir Macfarlane Burnet, the director of the Hall Institute, were keen to work together to promote medical research on local problems. Kuru seemed to offer them a good opportunity to do so.[39]

But D. Carleton Gajdusek, an American working at the Hall Institute, heard about these negotiations just before he left to return to the United States. The investigation of kuru was just the sort of diversion he sought. Gajdusek had already decided to break his journey in New Guinea, where he was planning to continue his child growth and development studies, but now he hoped also to resume his field studies of infectious disease, turning his attention this time to kuru. Most of Gajdusek's associates regarded him as a scientific prodigy, if also an erratic and sometimes irritating colleague. After graduating in medicine from Harvard, Gajdusek had worked with Linus Pauling and Max Delbruck at Cal Tech, John Enders at Harvard, and Joseph Smadel at Walter Reed, before spending a year or so at Burnet's laboratory, where he had helped to develop an autoimmune complement fixation test. Throughout his career, Gajdusek would interrupt laboratory work to travel to remote regions, where he would conduct informal surveys of the local diseases and investigate the more unusual ones.

[36] Berndt (1962b, 271).

[37] Arens (1979, 99). Arens points out, rather sardonically, that "the list of New Guinea cannibals and the recorders of their unseen deed is almost endless," p. 98. To be fair to Ronald Berndt, his account of cannibalism takes up no more than twenty-one out of more than 420 pages of text. The Berndts went on to long and distinguished careers as anthropologists of Aboriginal Australia, based at the University of Western Australia.

[38] Nelson (1996, 189). See also Zigas (1990). Zigas had a reputation as a showman and someone likely to embroider a story. See Gajdusek, "Preface," in Zigas (1990) and Lindenbaum (1 July 1990).

[39] F. Macfarlane Burnet papers (1923–1980).

At Melbourne, Burnet had found Gajdusek's personality "quite extraordinary." Although he was obviously very bright, Burnet worried that "you never knew when he would leave off work for a week to study Hegel or a month to go off to work with the Hopi Indians." Gajdusek seemed "completely self-centered, thick-skinned and inconsiderate," but equally he would not let "danger, physical difficulty, or other people's feelings interfere in the least with what he [wanted] to do."[40] Smadel, at Bethesda, believed that Gajdusek was "one of the unique individuals in medicine who combines the intelligence of a near genius with the adventurous spirit of a privateer."[41]

Gajdusek met Zigas at Kainantu; the two of them talked for days, scarcely stopping, about kuru. In March 1957, Gajdusek and Zigas went south and based themselves at Okapa (which the Berndts had called Moke), where Gajdusek observed the condition in many of the locals:

> Classical advancing "Parkinsonism" involving every age, overwhelming in females although many boys and a few men have it, is a mighty strange syndrome. To see whole groups of healthy young adults dancing about, with athetoid tremors which look far more hysterical than organic, is a real sight. And to see them, however, regularly progress to neurological degeneration in three to six months … and to death is another matter and cannot be shrugged off.[42]

Although even Gajdusek thought that kuru in its early stages resembled a hysterical condition, he had few doubts that it would turn out to be a disease with a biological cause, either infectious, toxic, or genetic. From Okapa he and Zigas proceeded to map the distribution of kuru in the Fore region. First, though, Gajdusek had to define the disease entity, or the clinical syndrome, which meant he had to identify a typical history, set of clinical signs, and prognosis for kuru. Gajdusek quickly learnt the basics of the Fore language so that he might understand the symptoms of the illness and its usual course; he used his skills in neurological examination and the instruments, such as plessors, that he had brought with him in order to elicit its typical signs. Soon he was able to differentiate "real" kuru from "hysterical" kuru. Once he had discerned a distinctive clinical pattern, he was then able to track its prevalence across the region, so long as his physical endurance and his boots held out on his arduous "patrols." He was, in effect, compiling the first census of the region. Over the next ten months he found that kuru was far more common, especially among the south Fore, than any outsider had suspected. Gajdusek estimated that during the previous twelve months there had been at least one hundred deaths from kuru in a population of eight to ten thousand, and that one per cent or more of the Fore population had been dying each year from kuru for the past five or possibly ten years. In some hamlets up to ten per cent of the population was sick with rapidly progressive disease; and because women and children were

[40] F. Macfarlane Burnet to J. Gunther, April 1957, in Farquhar and Gajdusek (1981, 41). Burnet resented Gajdusek's intrusion into a territory he had reserved for Australian scientists. Burnet received a Nobel Prize for his work in immunology in 1960.

[41] Smadel, quoted in Rhodes (1997, 55). Joseph E. Smadel was associate director of the National Institutes of Health and Gajdusek's leading supporter. He later found Gajdusek a position at the NIH. (Gajdusek was thirty-four years old when he arrived in the Fore region.)

[42] Gajdusek to J. E. Smadel, 15 March 1957, in Gajdusek (1976, 50). Gajdusek later refers again to "a remarkable tremor that appears more hysterical than organic," in Gajdusek to Smadel, 3 April 1957, (1976, 65).

most susceptible, some areas had a great excess of men in the adult population. "Could any more astounding and remarkable picture be found anywhere?" asked Gajdusek.[43]

At the same time as he was defining the disease of kuru, and mapping its prevalence, Gajdusek was also seeking to identify its cause. Before he entered the Fore region, his earlier work on infectious disease had led him to suspect that some infectious agent was responsible. "We even delayed our departure," he wrote, "to obtain buffered glycerine in which to store autopsy tissues for virus studies," and "when we entered the kuru region, we brought with us equipment to do further autopsies and to collect further specimens for extensive microbiological studies, especially serological and virological."[44] Gajdusek entreated Gunther in Port Moresby, Burnet in Melbourne, and Smadel in Bethesda to supply him with more equipment and his living expenses; he urged the Fore to donate samples of their blood, their cerebro-spinal fluid, their urine, and the bodies of their loved ones, and when his importunity no longer worked, he began to demand their bodies for science. In order to investigate the genetics of kuru he assembled charts of their kinship relations. To rule out a toxic cause, Gajdusek and a visiting nutritionist took samples of the environment and the food of the Fore. By August 1957, Gajdusek had complete charts on more than 150 kuru sufferers—or "patients" as he began to call them—including their histories, circumstances, genealogies, signs of disease, and the results of blood tests and other investigations. From these documents, he wrote, "we can study all that has been done, all that our laboratory tests have shown, and make all the analyses we wish from kuru."[45] The bodies of the Fore, their social life and environment, might thus be reduced to a mobile archive of signs and numbers, available for analysis at Okapa, Melbourne, Bethesda, or anywhere else.

Many of the blood tests and all of the autopsies were completed on site. Gajdusek struggled to acquire the necessary equipment to analyze and preserve the specimens he had collected, to transform the field so it was as much like a laboratory as possible. Soon after he arrived in the area, he wrote that "our immediate need is a treatment hut," for "to study the disease in the home and the village is hopeless."[46] Within a month he had established his "mat-floor hospital … in which we have a microscope, hemocytometer, a host of reagents, and all the diagnosis instruments that such a 'bush' hospital would be expected to possess."[47] But while some information had to be elicited on the spot, many of the more important specimens, especially the autopsy tissues, could only be studied by pathologists and other experts in distant laboratories. Sometimes Gajdusek found it difficult to prepare the specimens as instructed, so that they would be readable elsewhere. "We have no appropriate cannulas," he warned on one occasion, "nor is the cold wind and rushed excitement of 'bush autopsies' conducive to careful and accurate perfusion."[48] But he managed to maintain a copious correspondence with his colleagues in the outside world and to create a valuable trade with them. "It is difficult writing and working here in bush isolation," he wrote, "and I sadly feel the lack of colleagues and critical discussion."[49] Yet hardly a day went by without him typing letters and clinical records, and preparing material for analysis. Specimens, pho-

[43]Gajdusek to Smadel, 28 May 1957, in Gajdusek (1976, 91).
[44]Gajdusek, "Introduction," in Farquhar and Gajdusek (1981, xxiii).
[45]Gajdusek to Smadel, 6 August 1957, in Gajdusek (1976, 172).
[46]Gajdusek to R. F. R. Scragg, director of public health, PNG, 20 March 1957, in Farquhar and Gajdusek (1981, 22). Here Gajdusek's attitude toward fieldwork clearly contrasts with that of the Berndts.
[47]Gajdusek to J. E. Smadel, 3 April 1957, in Farquhar and Gajdusek (1981, 29).
[48]Gajdusek to J. E. Smadel, 8 July 1957, in Farquhar and Gajdusek (1981, 87).
[49]Gajdusek to J. E. Smadel, 10 July 1957, in Farquhar and Gajdusek (1981, 91).

tographs, films, letters, and reports went out by road and on the small planes; and equipment, reagents, medications, and visiting experts came in. The brains and other tissues from the autopsies, along with containers of blood and urine, were airfreighted out to metropolitan laboratories, their destination dependent on Gajdusek's relations at the time with Burnet and Smadel. And if Gajdusek was unsure how to fix and prepare the specimens, instructions soon arrived from neuropathologists and toxicologists in Australia and the United States.

Pathologists at the National Institutes of Health at Bethesda soon reported that the brains of kuru sufferers showed degenerative changes, especially in the cerebellum,[50] and they pointed out that these lesions were similar to those found in Creutzfeld-Jacob disease, and not unlike those of Alzheimer's disease. But the cause of the neuropathology remained uncertain.[51] The absence of inflammation and the failure to grow any pathogenic organisms led Gajdusek, reluctantly, to rule out an infectious cause. No toxic elements had been identified, and the neuropathology was not, in any case, typical of a reaction to a toxin. And while a genetic explanation remained attractive, it was unlikely that a single gene so deleterious could have reached the frequencies necessary to explain the prevalence of kuru among the Fore.[52] But whatever the cause of the disease, Gajdusek had managed in less than a year to create objects of extraordinary medical value in the exchange of kuru material. "If we can't 'crack' kuru," he wrote, "with hundreds of cases available for full study during any 3–6 month period, I see little hope for Parkinsonism, Huntington's chorea, multiple sclerosis."[53] Kuru was not just an affliction of the Fore: Gajdusek had made it essential to the understanding of neurological disease, whether local or global.

In medical journals and the popular press, the Fore region had become the kuru region (or the region of "laughing death" as many newspapers called it). The bodies of the Fore and their social life were reframed in terms of kuru, the territory was being restructured along the lines of kuru, the census of the Fore was a kuru census, and the map of the Fore was a kuru map. As Shirley Lindenbaum has observed, in the investigation of kuru, "Western medicine and colonialism were brought to many in a single encounter."[54] A medical reterritorializing and colonization of this sort was more than just a textual or literary accomplishment. Some parts of the bodies of the Fore, and bits of their environment, had begun to circulate around the world; and, in exchange, bits of science and medicine circulated among the Fore. How were these transactions understood? How were they negotiated and contested?

5.3 Medical Cannibalism

Stories of Fore cannibalism fascinated Gajdusek. In his first letter to Smadel from the "kuru region," Gajdusek had boasted that he was "in one of the most remote, recently opened regions of New Guinea … in the center of tribal groups of cannibals, only contacted in the last ten years and controlled for five years—still spearing each other as of a few days ago, and cooking and feeding the children the body of a kuru case." But he was sure that

[50] Carl G. Baker to Gajdusek, 26 July 1957 in Gajdusek (1976, 164). The discovery of the new disease was announced in Gajdusek and Zigas (1957).

[51] Ronald Berndt maintained that the presence of neuropathology did not rule out a psychosomatic cause, but this argument carried little weight with the medical investigators.

[52] For many years Gajdusek believed that the most likely explanation was that the Fore were genetically predisposed to react to a peculiar toxin.

[53] Gajdusek to J. E. Smadel, 25 August 1957, in Farquhar and Gajdusek (1981, 121).

[54] Lindenbaum (1 July 1990).

"although the people are still current warriors and cannibals, they are well 'under control' and very cooperative."[55] A few months later, one of Gajdusek's Fore friends reported that his clansmen had eaten his grandfather "against his advice." "Such recent, nay current, episodes of cannibalism," Gajdusek wrote, "are not unusual here, but it is highly unlikely that all of our kuru patients have eaten human brain." All the same, it was an enticing thought. "It is so unique a concept, and such a romantic one, that I almost wish cannibalism was more prevalent than it is."[56]

During his fieldwork, Gajdusek would often try to titillate the readers of his letters with associations between cannibalism and his medical investigations, in particular the autopsies.[57] From the beginning he had tried to secure the brains and other viscera of those who died of kuru. "Autopsy material," he wrote to Smadel, "is most difficult to obtain and will require time and much persuasion, but we shall get it. We promised one brain to Melbourne, but if you can promise expert neuropathology, I shall get one off to you."[58] He had to dissect the bodies wherever he could and then perfuse and fix the tissues in his "bush hospital," on the same table where he wrote reports and ate his meals—his "autopsy-tea? lab-typewriting-bench-emergency surgery table that must be cleared for meals three times a day."[59] Once the tissues were ready he would send them away to Melbourne or Bethesda for further study. Usually, it was not easy to persuade the Fore to part with the body of their loved one. And yet, he was often successful. "I write at the moment to let you know that we have had a kuru death and a complete autopsy. I did it at 2 a.m., during a howling storm, in a native hut, by lantern light, and sectioned the brain without a brain knife."[60] But after another autopsy Gajdusek told Smadel that "they are precious specimens, and have cost us heavily in time and effort to obtain under these primitive conditions, where even the suspicion of sorcery worked on body parts or excreta is a great hindrance."[61] When sending some brains to Bethesda, Gajdusek warned that "we were lucky to get two and may get further ones, but our ex-cannibals (and not 'ex') do not like the idea of opening the head."[62] At the same time as Gajdusek was negotiating for the bodies of the kuru dead, then dissecting them on his dining table and ritually preparing them for scientific consumption, native cannibalism had been forbidden by the Australian authorities.

Gajdusek's facetious references to his medical cannibalism indicate some perplexity about the character of the transactions he was engaging in, and therefore some indecision

[55]Gajdusek to J. E. Smadel, 15 March 1957, in Gajdusek (1976, 50–51). Smadel was concerned that Gajdusek might get eaten: "What will happen to the records, the material, and the information that you carry in your head if the plane comes down in the jungle or if one of the indigenes decides to revert to cannibalism?" In Smadel to Gajdusek, 16 August 1957, in Gajdusek (1976, 177). On the continuing appeal of the cannibal metaphor in medicine and science, see Arens (1998).

[56]Gajdusek to J. E. Smadel, 27 September 1957, in Gajdusek (1976, 234). Gajdusek had discounted any connection of cannibalism and kuru as soon as he ruled out any infectious agent.

[57]Peter Galison observes that in physics "experimenters like to call their extractive moves 'cannibalizing' a device," in *Image and Logic* (1997, 54).

[58]Gajdusek to Smadel, 3 April 1957, in Gajdusek (1976, 67).

[59]Gajdusek to Smadel, n.d. (late May 1957?), in Gajdusek (1976, 95). This gives another meaning to Gajdusek's offhand remark that "I hope to begin digesting our data shortly," in Gajdusek to Roy Simmons, 30 June 1957, in Farquhar and Gajdusek (1981, 81).

[60]Gajdusek to Smadel, n.d. (May 1957?), in Gajdusek (1976, 88).

[61]Gajdusek to Smadel, 28 May 1957, in Gajdusek (1976, 90).

[62]Gajdusek to Smadel, n.d. (late May 1957?), in Gajdusek (1976, 94). For more on the difficulty of obtaining autopsies, see Gajdusek to Smadel, 29 June 1957, in Gajdusek (1976, 119). The comment on the distaste for opening the head is strange, given the later claims that kuru was transmitted through the eating of human brains.

about his own identity on the scientific frontier. What did it mean for a scientist to imagine himself as cannibal? For endocannibals, those like the Fore who may occasionally engage in the consumption of their relatives, the ritual permits, in Peggy Sanday's terms, the regeneration of "social forces that are believed to be physically constituted in bodily substances or bones at the same time that it binds the living to the dead in perpetuity."[63] Endocannibalism is generally a means of communicating social value from one generation to the next. But medical cannibals surely must be exocannibals, consuming the bodies not of loved ones but of outsiders. In casting himself as an exocannibal, was Gajdusek attempting to simplify and control apparent disorder, imagining a means of drawing on the resources of others without becoming other?[64] Was he, at the same time, indulging in an unsettling fantasy of consumption without reserve, a desire that implied its own impossibility? Medical exocannibalism could structure the work of colonial science in terms of absolute consumption, while acknowledging that the relations of dominance and submission that might permit such a feast were interdicted—thus "cannibal appetite is its own impossible desire."[65] Above all, the emergence of the metaphoric cannibal at this moment marks a crisis in Gajdusek's exchange relations with the Fore.

It may seem remarkable in these circumstances that Gajdusek resisted the trope of headhunting. Certainly, he believed that the Fore routinely resorted to headhunting; moreover, the Berndts had suggested that headhunting rumors circulated widely among the Fore; but Gajdusek, even in wildest flights of fantasy, neither represented himself as a headhunter, nor did he hear that he was so accused. And yet, is Gajdusek's reluctance to assume the role of scientific head? hunter really so surprising? According to Janet Hoskins, headhunting is "an organized, coherent form of violence in which the severed head is given a specific ritual meaning and the act of head-taking is consecrated and commemorated in some way." The severed head, a trophy of combat, embodies a form of vitality. In Melanesia, "headhunting" has been used "to speak metaphorically about other relationships, which might be characterized as ones of inequality, economic exploitation, and an unequal voice in political decision-making." Hoskins suggests that "heads are taken—in the imagination as in traditional practice-to seize an emblem of power, to terrify one's opponents, and to transfer life from one group to another."[66] Thus if cannibalism, even exocannibalism, implied an unresisted appropriation of the body of the other, an absolute corporeal consumption, headhunting called attention to its violent expropriation. Gajdusek was prepared, imaginatively, to simplify his exchange relations with the Fore, to joke about his medical cannibalism, but he was not ready to imagine any violence in his desire for an unreserved consumption. But even as he foreswore headhunting, the scientist must also have realized that he could never simply become cannibal.

[63] Reeves Sanday (1986, 7). Marshall Sahlins has speculated on the role of ritual cannibalism in the origin of social order, in "Raw Women, Cooked Men, and Other 'Great Things' of the Fiji Islands," in Brown and Tuzin (1983).
[64] On the problem of social reproduction, see Weiner (1982). On similar means of renewing human energy, see Rosaldo (1977).
[65] Bartolovich, "Consumerism, or the Cultural logic of Late Cannibalism," in Barker (1998, 234).
[66] Hoskins (1996, 2–38). On exchange models for understanding the cultural logic of headhunting, see George (1991). For an attempt to use the trope of headhunting to explain the collecting practices of A.R. Wallace and H.O. Forbes, see Pannell (1992).

5.4 Kuru as Commodity, Kuru as Gift

The bodies that Gajdusek sought were entangled in a confusion of exchange relations and social obligations:

> It looks as though further autopsy materials may be unobtainable. Thus, the natives have given up our medicine … they know damn well they do not work … and I am fighting (verbal battles in Fore), bribing, cajoling, begging, pleading, and bargaining for every opportunity to see a patient, and strenuously working tongue muscles for hours for every further day we get a patient to stay in hospital, accept therapeutic trials, etc. etc. Vin is sick and tired of the "duress of personality" which is required to pressure every case into our care and I do not like the effort. It means, however, that unless we start curing cases quickly, we cannot expect any clinical material much less any autopsy specimens. I am willing to keep up the push using every ruse short of actual duress by force and authority … that we cannot contemplate.[67]

In making a gift of their blood, urine, cerebro-spinal fluid, and the bodies of their loved ones, the Fore had created a social obligation, a social debt that Gajdusek recognized and struggled to repay. (In such gift transactions, as Mauss pointed out, the "objects are never completely separated from the men who exchange them," suggesting that anxieties about the control of exchange are also concerns about the transformation of identities.[68]) In return, Gajdusek tended the wounds of the Fore and gave them antibiotics to treat mundane infections, and he plied the kuru sufferers with virtually every drug Western medicine had to offer. Gajdusek dispensed antihistamines, ACTH, sulfonamides, chloramphenicol, vitamins, iron, phenobarbital, artane, BAL, anticonvulsants, testosterone, and other medications to his kuru patients, all to no effect—or at least none that he could recognize.[69] Before long, it appeared to Gajdusek that many of the Fore were becoming indifferent to his gifts. Even so, he observed, with a degree of perplexity, that "to humor me and repay my many miles of mountain climbing to track them down, they haul the litters over miles of cliff-faced and precipitous jungle slopes to bring patients in for another shot at our therapeutic trials and experimental poking … I admire and respect them thoroughly."[70]

Kuru brains and the other local objects of interest to scientists could not simply be appropriated. Gajdusek, like the Berndts before him, was participating, perhaps unwillingly, in a complex and ambiguous moral economy. The Berndts had tried to resist it, for although they lived in a house that the local inhabitants built for them, they did not like the Usurufa

[67] Gajdusek to Smadel, 24 November 1957, in Gajdusek (1976, 309–10). Earlier, Gajdusek had written to Gunther: "We have ticklish problems in trying to avoid any trace of coercion of the natives. We have gained their confidence around Moke." In Gajdusek to J. Gunther, 3 April 1957, in Farquhar and Gajdusek (1981, 28–9).

[68] Mauss ([1925] 1970, 31).

[69] See list in Gajdusek to Burnet, April 1957, in Gajdusek (1976, 72). Gajdusek later complained that "everyone wants *shoots* and pills and they want these in return for saying they are *sik*. To get a further history and symptomatology from them is a long and tedious task and to satisfy them they must have as many pills as the next man." In Gajdusek (1964, 98) [27 March 1960].

[70] Gajdusek to Smadel, late May 1957, in Gajdusek (1976, 92). On a later field trip, Gajdusek wrote of one of his Fore friends: "I admire him and am deeply grateful that my little attentions to him and his people have resulted in such an unusual show of allegiance and accord. I only hope I can justify it." In Gajdusek (1964, 59) [17 March 1960].

and the Fore peoples, and they refused to supply the valuables that were expected. When finally they left the house, complaining about the constant pilfering, their former hosts treated them with hostility.[71] But Gajdusek seems to have established more conventional exchange relations with the Fore, building an alternative men's house and a store house (or hospital), from which he dispensed medical goods. He engaged, too, in the local commodity transactions, bartering axes and other objects for pigs and vegetables, and carrying "trade items," such as salt, kina, beads, and tobacco, with him as he patrolled the region.[72] Gajdusek found the neighbouring Kukukuku (later known as Anga) to be especially keen traders, "reminiscent of Latin Americans. Rather than accept whatever we offer, they bargain and haggle. Furthermore, they know how to bargain shrewdly and set a price, to reject offers they deem unsuitable, to suggest better ones, and to insist upon prices we either cannot pay or have not the items to pay with."[73]

Some things had a price, but the ones that Gajdusek most wanted—blood, body fluids, corpses—either were out of circulation altogether or could only be given as gifts. On some occasions Gajdusek did try to commodify the exchanges, but with little success. "I did a complete autopsy in our treatment/laboratory hut by lantern light, and then at first cockcrow got the body borne homeward with the mourning mother well rewarded with axes and salt and laplap," but the mother paid little attention to these objects.[74] Although the Fore were not yet engaged in a monetary economy, Gajdusek could at least try to convert all his transactions into a form of barter. Generally, in barter transactions the relationships between the parties are discontinuous and unstable; an exchange ratio, or substitutability, is determined during the bargaining, and through this process, "barter exchange creates equality out of dissimilarity." Some trust between parties is still necessary, but the relationship formed tends more toward "reciprocal independence," in contrast to the "reciprocal dependence" of gift exchange.[75] However, as Nick Thomas points out, "what for one side is a gift relationship may be barter for the other."[76]

The advantages to Gajdusek of representing his exchanges with the Fore in terms of barter are evident. In receiving a gift from the Fore, Gajdusek knew he was incurring a debt he was unlikely to repay in a satisfactory manner. Moreover, the gifts he received would always be bound to their original owners, to some extent inalienable even if out of their control, to some degree still attached to the Fore even as they were received into other hands.[77] And yet, if Gajdusek was to take scientific credit for his work, he somehow needed to alienate these objects from the Fore, to treat them as commodities like any other, or to consume them, cannibalize them. He was attempting to mark out a boundary that separated the Fore from their goods, to put a line between local and global exchange regimes, and thus

[71] Berndt (1992). The Berndts certainly recognized that they were expected to present gifts to the Fore: see Berndt (1954, 271–2).

[72] Gajdusek to Yin Zigas and Jack Baker, 1 Sept 1957, in Gajdusek (1963, 40). Gajdusek often found it difficult to "retain equilibrium in the complex plurality of relationships which I have here in this region." Gajdusek (1964, 137) [16 April 1960].

[73] Journal, 5 October 1957, in Gajdusek (1963, 76).

[74] Gajdusek to Burnet and Anderson, 19 May 1957, in Farquhar and Gajdusek (1981, 57).

[75] Humphrey and Hugh-Jones (1992). See also Gregory (1982, esp–42).

[76] Thomas (1992, 38). Thomas also makes the point that "barter has always been associated with social margins," p. 21.

[77] On the notion of "keeping while giving," see Weiner (1985). In such cases, "the affective qualities constituting the giver's social and political identity remain embedded in the objects so that when given to others the objects create an emotional lien upon the receivers," p. 212.

produce a space in which he might assimilate or circulate scientific valuables. But much as Gajdusek may have wanted simply to "cannibalize" or consume the bodies of the kuru dead, he was never able to do so. Nor could he simply treat kuru brains as commodities, as objects of abstract or negotiable value alienated from their original owners and thus available for barter. "Kuru brains," Gajdusek wrote, "are not a commodity on the open market, nor will they ever be; we are lucky to get any."[78] Try as he might to possess or appropriate kuru brains, the exchange of gifts in medical research had bound him to the Fore, brought him into a relationship of mutual obligation and unbalanced reciprocity.

The character of exchange relations derives from prevailing cultural assumptions about the objects, the transactors, and the place in which their encounter occurs.[79] Depending on the social arena—whether, for example, it is a marketplace, a clinic, or a home—the object may move in and out of commodity or gift status. In cross-cultural encounters the possibilities for error, for misrecognition of transactions, are multiplied; and since gifts imply a social reciprocity, the "mistakes made in giving have consequences that commodity transactions almost never have."[80] When, for example, Gajdusek took blood from the Fore, he understood that it was given freely, that it had no price, and that it required something in return. But he seems to have no way to gauge the quality of the gift, its rank among the objects that the Fore might give to strangers. On one occasion, Gajdusek found that "no protest or difficulty bleeding anyone was encountered and the natives evidenced some disappointment when we ran out of bleeding containers."[81] But later, he conceded that "the fact is that I have done so much bleeding of primitive people that I am, in all possibility, a little over-confident."[82] His over-confidence in his judgement of value and decorum could lead to misunderstandings.

In accepting the gift of blood Gajdusek was becoming inextricably entangled in local ideas about wounds, menstruation, propitiation, and identity. In a society where female menstruation was regarded as demeaning and dirty, and imitative male bleeding was viewed as strengthening and purifying, the taking of blood must surely have had a different significance depending on the gender of the donor. It would seem likely that the Fore connected Gajdusek's efforts at bleeding the men with the bloodletting rituals that marked male initiation, but if so, Gajdusek was unaware of any definite association.[83] For Gajdusek, the meaning of blood was primarily medical. The Berndts had been more interested in the symbolic meanings of blood, but then, of course, they had never tried to acquire any of it. They noticed that blood was split and sprinkled, used for anointing participants in rituals, or sprayed on objects awaiting transformation in the store houses:

> Blood (whether of pigs or of men) is a "human" element, and is thus a desirable substance from the spirit's point of view. Blood is, in essence, "life," so that in presenting blood gifts to the spirit, the inference is that it will come into the human orbit. Moreover, blood being a symbol (more than that, a necessary

[78] Gajdusek to Smadel, n.d. (late May 1957?), in Gajdusek (1963, 93).
[79] Appadurai (1986). Thomas also points out that cross-cultural exchange "frequently entails differing assumptions or claims about whether a thing is a commodity or a gift, as well as divergent views of the commodity candidacy of things and the context of exchange itself" *Entangled Objects* (1991, 30).
[80] Thomas (1991, 15).
[81] Gajdusek to Yin Zigas and Jack Baker, 8 September 1957, in Gajdusek (1963, 48).
[82] Journal, 28 September 1957, in Gajdusek (1963, 57).
[83] On these rituals, see Berndt (1962b, 94–104) and Lindenbaum (1976, esp–57).

> component) of life or reality, the sprinkling of blood over leaves, sand and stones which are placed in the special house means that their reality is ensured: they are bound to tum into real objects.[84]

Gajdusek's specimens were gifts of a special order, but his apparent failure to recognize their status must have distorted or attenuated the bonds forged in the exchange.

5.5 The Brains Trust

Just as the Fore were seeking to bring Gajdusek into their orbit, Gajdusek was attempting to create social bonds with leading scientists in Melbourne and Bethesda. Above all, if Gajdusek was to receive adequate social credit in a scientific exchange regime, the recipients had to recognize the objects as priceless gifts, not commodities on an open market. (When Gajdusek wrote to Smadel pointing out that kuru brains were not commodities and that "we" were lucky to get one, he probably meant that it was Smadel who was lucky to get one.) As Marilyn Strathern observes, in gift exchange "people must compel others to enter into debt: an object in the regard of one actor must be made to become an object in the regard of another." In acquiring and making available the kuru brains, Gajdusek was attempting to anticipate the "extractive perspective" of his colleagues in Melbourne and Bethesda, to "objectify" his new assets.[85]

But even if the recipients recognized the objects as gifts, did they recognize the donor? As gifts, the objects would remain to some extent inalienable from their original owner, so it was necessary for Gajdusek in his relations with Burnet and Smadel to abstract the objects from any associations with the Fore, to recontextualize the brains as his possessions, not the Fore's. Thus, for Gajdusek to donate kuru material—for him (and not the Fore) to gain credit and visibility in the exchange—he would always need to construct a clear boundary between local and global exchange regimes. Fore bodies might be a local asset, but with clever "boundary-work" kuru brains would become part of Gajdusek's inalienable wealth in a series of scientific gift exchanges.[86] Burnet and Smadel thus accepted the gifts as "Gajdusek's kuru brains," not as generic and valueless Fore brains. The scientific exchange objects became part of Gajdusek's inalienable wealth, proof of his immortality, his power.[87]

But it is, of course, a little more complicated. For even when his colleagues came to regard them as "Gajdusek's kuru brains," these objects still retained some Fore aura. Indeed, an exotic association was part of their exhibition value. But the exchange value depended on inserting tissue fragments (Gajdusek's fragments) into a scientific network—indeed it required these reframed pieces to bring together such a network and thus to become meaningful and valuable. In making these brains—his brains—scientifically serviceable, Gajdusek was ensuring that the aura of the Fore shriveled: it was reduced, but did not disappear.[88] In a scientific exchange network, the attachment of these objects to the Fore would be no more, and no less, than a distant claim of provenance.

Gajdusek carefully allocated his gifts of blood, brains, and other tissues to competing scientific institutions so that leading metropolitan figures incurred increasing social debt to

[84] Berndt (1954, 226).
[85] Strathern (1992, 177–178).
[86] On boundary construction and maintenance in science, see Gieryn (1983). See also Gray (1984, 54–2).
[87] See Weiner (1985).
[88] Benjamin (1969).

him. As the objects were scarce and could be linked to important medical problems, great value was conferred on them in the exchange. In return, Gajdusek received recognition, an institutional affiliation, research support, and, eventually, a Nobel prize. Among the Fore, Gajdusek had observed big men manipulating competitive ceremonial exchange systems in order to enhance their social status. In science too, one could manage networks of exchange partnerships in a drive for credit. Whether among Melanesians or among scientists, "for big men it is important both to have large networks and to manage them well."[89]

But Gajdusek also found that not all objects of scientific interest could enter into circulation (and some of them, like kuru brains, might be withdrawn from circulation when exchange relations went awry). Early in his fieldwork, Gajdusek had promised Australian investigators a live kuru sufferer that they might study in their metropolitan clinics. He proposed

> sending an ideal case to Brisbane, Sydney or Melbourne for study in a unit such as Dr Wood's Clinical Research Unit. This would yield, in the long run, far more information and far more reliable results at a far smaller expense than all sorts of half-hearted efforts at getting experts and equipment into the highlands…. Now, I am not suggesting accepting a classical early case on the Clinical Unit ward for autopsy purposes, but rather for clinical study and evaluation.[90]

He thought at the time that shifting such a "case" out of the region would not bother the Fore and might make it easier to obtain the autopsy, but he soon found that the Fore were more likely to permit an autopsy than to allow someone to die away from their relatives and community. Some objects could not be abstracted from their local context, could not be mobilized and repackaged as gifts in a global scientific network. (And in any case, Gajdusek's own relations with the Melbourne researchers, the most likely recipients, had rapidly broken down.)

The exchange of materials and the reproduction of social relations in global science required constant work and unfailing tact.[91] Since gifts were exchanged within a common culture, mistakes were less likely than in the exchanges between Gajdusek and the Fore. But all the same, the transactions were complicated, requiring sensitive calculation and management. In regulating the brain wealth of Melbourne and Bethesda, Gajdusek was industrious, but not always discreet. His intrusion into Australian territory had already offended Burnet, and relations were not properly mended even after he gave the first kuru brain to the Hall Institute. Burnet soon realized that Gajdusek sent most of the other tissues from the first autopsy, and most of the brains from later autopsies, to Smadel at the NIH.[92] Dr. E. Graeme Robertson, the Melbourne pathologist who examined the first brain, thought that it was "reprehensible to send specimens to two places without informing the other. … I am baffled by it all, and obviously do not understand all the facets—therefore the less said the better. I have mentioned my reaction to Sir Macfarlane Burnet and he agrees about it."[93]

[89]Strathern (1971, 221). See also Sahlins (1963).
[90]Gajdusek to Burnet, 13 March 1957, in Farquhar and Gajdusek (1981, 6). Ian Wood was the director of the Clinical Research Unit, a division of the Hall Institute.
[91]I hope that I will later be able to link this analysis of the exchange regimes of kuru science to issues of trust and civility, as raised by Steven Shapin (1994).
[92]Gajdusek to Smadel, n.d. (May 1957?), in Gajdusek (1976, 88). He later wrote to Smadel (10 July 1957) that "we have two further brains on our hands already—one for you and one for Melbourne" in Gajdusek (1976, 145).
[93]Graeme Robertson to J. G. Greenfield, NIH, 31 October 1957, in Gajdusek (1976, 305).

Gajdusek defended himself to Smadel, his principal sponsor. "Although I have attempted to deal directly with all our collaborators," he wrote, "prestige and publicity considerations have brought in numerous 'intermediaries' at many stages. … Yes, Joe, Australian feelings have been hurt by not having everything on kuru studied in their hands."[94] But when Australians recognized his work and visited him, Gajdusek could be generous with his material. Toward the end of his first stay in the highlands, Gajdusek sent two brains off to Smadel but gave another to Sydney Sunderland, the dean of the medical school at Melbourne, who recently had visited him and praised his work.[95] At Bethesda, a gift of brains might increase Gajdusek's rank; at Melbourne it might repair relationships. In the gift economy of global science, mistakes in giving could be costly, but then, one could usually try again to give creditably.

5.6 The Fate of Kuru

In August 1957, while still in the Fore region, Gajdusek despaired of ever finding an adequate scientific explanation or treatment of kuru. "Sorcery," he admitted, "seems as good an explanation for it as any we can offer them."[96] After Gajdusek left New Guinea in November 1957, he continued to think about a possible cause of kuru, and for many years he favored the notion that the Fore were genetically predisposed to react in a peculiar and pathological way to some unidentified substance. Smadel found him a place at the NIH, where he spent the remainder of his career, but through the 1960s Gajdusek still managed to return frequently to New Guinea and visit his Fore friends.

Soon after he left the highlands in 1957, Gajdusek had assembled a travelling exhibition on kuru which displayed the most vivid pathological features of the condition. A veterinary specialist who viewed the exhibition in London noticed that many of the pathological findings in kuru resembled those seen in scrapie, a degenerative disease of sheep which was clearly infectious.[97] Initially Gajdusek was skeptical, but he arranged for Joe Gibbs to begin inoculation experiments in chimpanzees at the Patuxent Wildlife Center, using some fresh kuru brains sent over by Michael Alpers, an Australian who was studying kuru in New Guinea.[98] (The fact that Gajdusek and others could still identify that the inoculants had come from Fore patients named Kigea and Enage indicates the persistence of an aura of previous possession.) In 1965, a few years after their exposure, the chimps began to shake and lose their balance, and when the animals were "sacrificed," the autopsy on their brains found changes indistinguishable from those of kuru.[99] But if kuru was transmissible, what was the agent? How did it spread in natural conditions? And why did it take so long to become clinically obvious?

When Gajdusek returned to the Fore in 1961 he met Robert Glasse and Shirley Glasse (later Lindenbaum), anthropologists who had based themselves at Wanitabe to study kuru sorcery and the recent exacerbation of tensions between Fore men and women. Because

[94] Gajdusek to Smadel, 7 December 1957, in Gajdusek (1976, 336).
[95] Gajdusek to Smadel, 24 December 1957, in Gajdusek (1976, 342).
[96] Gajdusek to Smadel, 6 August 1957, in Gajdusek (1976, 173). Later, on 17 September 1957, Gajdusek wrote to Smadel, "THUS FAR WE CANNOT FIND A SINGLE CLUE," and "I can find no toehold from which to start infectious disease or toxicological study," in the Burnet papers (1957–1963).
[97] Hadlow (1959). See also Hadlow (1992).
[98] Alpers (1992).
[99] Gajdusek, Gibbs, and Alpers (1966). See also Rhodes (1997); Nelson (1996).

the aim of these two researchers was "to consider the effects of both the new sociopolitical order and epidemic disease on the Fore," their fieldwork relied in part on the new medical interpretation of events, making them, in contrast to the Berndts, participants in "a multidisciplinary project."[100] Between 1957 and 1977, more than twenty-five hundred local inhabitants would die from kuru, eighty percent of them from the Fore language group. In the early years, two hundred people, mostly women and children, were dying each year; this annual mortality amounted to more than one per cent of the population. Throughout this period the Fore continued to attribute kuru to sorcery. The local explanation of disease emphasized "malign human agents and disturbed social relations"; sorcery beliefs helped to define group boundaries and consolidate local communities at the same time as they worsened many social tensions.[101] Kuru sorcery seemed mostly directed at women, and the Fore were concerned that before long the women might all be dead, the victims of a few malevolent male sorcerers. Affected communities sought out "dream men" to treat the sorceries of the 1950s and 1960s. Dream men usually came from the border areas between language groups, and used the dreams that followed ingestion of psychotropic plants in order to disclose enemies. Like Gajdusek and the medical orderlies, they were one group among many candidate curers. But while the Fore quickly lost patience with purveyors of biomedical remedies, the dream men acquired considerable wealth and often became big men. "Fore express social relationships through reciprocal exchanges of goods and services," wrote Lindenbaum. "Without reciprocal exchanges, harmonious relationships cannot exist." The Fore had therefore provided Gajdusek and other outsiders "with territory, food and services, and they expected a reciprocal endowment of valuables." But on this occasion they soon had become disillusioned.[102]

Glasse and Lindenbaum proposed that some unidentified agent causing kuru might be passed on by cannibalism, an echo of similar speculations by Ann and J. L. Fischer, anthropologists at Tulane who had read the work of the Berndts. Yet no transmissible agent was identified at the time.[103] However, now that Gajdusek and Gibbs had proven that kuru was an infectious disease, the role of cannibalism had to be reconsidered.[104] As Walter Arens suggests, "the anthropological fixation on cannibalism in the field [had become] more compatible with laboratory experiments."[105] At first, Gajdusek was unhappy with the attempts to associate kuru and cannibalism, as he thought that the disease was already exotic enough. But Alpers and John Mathews independently came to the conclusion that the epidemiological evidence supported the association. Transmission by endocannibalism appeared to explain the age and sex distribution of kuru, its familial distribution, and the fact that the latest gen-

[100] Lindenbaum (1979, viii). Glasse was an American who received his Ph.D. in anthropology from the Australian National University; and Lindenbaum had trained in the Sydney anthropology program.
[101] Lindenbaum (1979, 72).
[102] Lindenbaum (1979, 111).
[103] Fischer and Fischer (1960, 1417–8).
[104] Glasse (1967). See Glasse and Lindenbaum (1992).
[105] Arens (1979, 109). Arens argues that an epidemiological association of kuru with cannibalism is just "a hypothesis based on circumstantial evidence," and the disease may also have been associated with European contact or other changes in lifestyle, p. 112. He quotes Burnet, who in 1971 warned that "it would be unfortunate if too easy acceptance of the cannibalism hypothesis should handicap further inquiry into the pathogenesis of kuru." See Burnet (1971, 5). Interestingly, Berndt had claimed that "people do not normally eat the victims of dysentery or guzugli sorcery," in *Excess and Restraint* (1962b, 270). However, Lindenbaum pointed out that the Fore would not eat those with dysentery or leprosy, but kuru victims "were viewed favourably, the layer of fat on those who died rapidly heightening the resemblance of human flesh to pork," in *Kuru Sorcery* (1979, 20).

eration of Fore children, born since the suppression of the practice, was with few exceptions growing up without succumbing to the disease.[106] Kuru had thus begun to disappear even before the scientific explanation for it had been assembled.

By the late 1960s, the science of kuru seemed more or less settled: its cause was a "slow virus" (to use Gajdusek's term) spread among the Fore if not strictly by endocannibalism, then by handling of the body in funerary rites.[107] For the discovery of the slow virus, a new etiology of human disease, Gajdusek was awarded a Nobel prize in 1976. His model of causation also appeared to explain Creutzfeldt-Jacob disease and, later, bovine spongiform encephalopathy (BSE); and it shaped the direction of research into the cause of AIDS. But Gajdusek's slow virus was chemically just a protein, a "virus" without DNA or RNA. The next generation of scientists preferred to call the agent a prion, a transmissible protein with peculiar stereochemical properties, and it was for this notion that Stanley Prusiner later received a Nobel prize.[108] At the end of the 1980s, the slow virus, for which Gajdusek had won his earlier Nobel prize, was as elusive as kuru.[109] But by then, Gajdusek had used his valuables to become a dream man in medicine, a big man in science.

5.7 Conclusion

In this essay I have tried to demonstrate the tension and confusion—and sometimes hybridization—between forms of appropriation ("cannibalism"), commodification, barter, and more reciprocal forms of exchange in colonial science. I have sought to understand what it meant for Gajdusek, and for Burnet and Smadel, to get their hands on kuru brains. In describing just one example of the complex, and often ambiguous, process of creating value in modern medical science, I also wanted to trace, more generally, the outline of a moral economy of scientific exchange, with its characteristic ways of assigning intellectual credit and recognizing social debt. But there are, of course, other issues raised by this story that I have not considered here. What, for example, was the role of scientific and colonial bureaucracies in regulating these transactional orders? How did middlemen—such as medical orderlies—influence exchange relations? In what way was the gender of the gift—most of the dead were female—significant? Most importantly, what did the Fore really make of all these investigations? On such issues the historical record is still confusing or opaque, or simply unavailable.[110]

It appears that for Gajdusek, in particular, the alienability of kuru brains, whether from the Fore or from himself, became a crucial issue in fieldwork and laboratory practice. It was never certain who rightfully possessed kuru material, or even what it might mean to possess it, or more importantly, how to give it away and still keep it. But if Gajdusek were to earn scientific credit in his exchanges with senior colleagues, if he were to imprint his name on kuru research, it was necessary for him to alienate kuru material from the Fore,

[106] Alpers (1965); JMathews, Glasse, and Lindenbaum (1968).

[107] Gajdusek (1997). Kuru was not transmitted experimentally through the gastrointestinal tract, so Gajdusek suggested that the route of transmission might be skin contact with the contaminated brain. See Gajdusek et al. (1997, 1253).

[108] Prusiner (1982).

[109] Gajdusek estimated that more than twenty-five hundred Fore had died of kuru between 1957 and 1982, by which time it was rare. For a review, see Gajdusek (1990).

[110] I hope to address many of these issues in a larger work on kuru exchanges, but some of the limitations of the historical record may mean that many of these questions are never answered satisfactorily.

to take possession of their body parts, and then to circulate them as gifts within a scientific network. No matter how variable Gajdusek's understanding and representation of his transactions with the Fore, one feature is constant: the need to make kuru material his own, or appear to be his own, even if previously it was out of circulation altogether, even if it, or he, was still tied to the Fore through a gift relationship. Among the Fore, such willful misrecognition of exchange—whether the illicit circulation of valuables or the denial of reciprocity in transactions—would have put the perpetrator in moral peril.[111] But Gajdusek remained a scientist, a member of a different community. Thus, having oversimplified the transactions that had taken place between himself and the Fore, Gajdusek proceeded to rework and exchange "his" kuru goods for recognition in science. Once the material had been carefully demarcated from its "conditions of possibility," Gajdusek was readily identified as the primary author of kuru, and given scientific credit and rewards for his discovery.[112] He was able to insert his valuables into a complex moral economy of science.

The changing economic articulation of scientific research—commonly expressed as a tension between authorship and ownership—will no doubt be more profitably explored only as we begin to piece together the material cultures of a greater range of recent scientific transactions. It would, for example, be helpful to compare kuru transactions with the contemporary, and perhaps more commodified, global traffic of genetic material.[113] Gajdusek's own career offers hints of a new transactional order emerging in science. In the 1990s, he was the director of the Central Nervous System Laboratory of the National Institute of Neurological Disorders and Stroke when it applied for a patent on a cell line from a Hagahai man, and he was named as an inventor in a similar claim on a cell line from a Solomon Islander. In May 1989, Carol Jenkins, a medical anthropologist affiliated with the Papua New Guinea Institute of Medical Research (led by Michael Alpers), had drawn blood from Hagahai men and women infected with a retrovirus known as HTLV-1. The virus was common in the region, but unlike elsewhere, in Papua New Guinea it rarely seemed to cause leukemia. The infected T-lymphocytes were extracted in Goroka and sent to the National Institutes of Health, where scientists suspected that the cell line, infected with the variant virus, might prove useful in diagnostic testing and vaccine development. Given the precedent of kuru, it is perhaps not surprising that no one consulted the Hagahai or the government of Papua New Guinea before applying for a patent on the cells.[114] But the difference in the transactional order of science is remarkable. In the 1950s and 1960s Gajdusek had circulated Fore material within the reward system of science, while in the 1990s he was participating directly in the market commodification of Hagahai cells. Once an author, Gajdusek had become a

[111] Parry (1989). Gajdusek regularly brought children back from his research trips and sent them to school in the United States. By the 1990s, more than fifty children had lived in his house. In 1996, Gajdusek was charged with the abuse of one of them, and he pleaded guilty. Although it may be tempting to seek facile analogies between the collection of children and of body parts, it seems that the exchange relations were quite different in character—as was the appreciation of moral peril.

[112] Biagioli (1999).

[113] On the changing transactional orders of science, see Nelkin (1984); Zuckerman (1988); Haraway (1997, 244–53); Krimsky (1999); Lock (1999).

[114] Jenkins maintained good relations with the Hagahai, and promised them half the royalties from the patent. Patent No. 5,397,696—for the DNA sequence "PNG human T-lymphotrophic virus (PNG-1)—was later dropped after protests from the Papua New Guinea government and activists who alleged "biopiracy." See Lehrman (1996a, 374, 1996b, 500); http://www.cptech.org/ip/rafi.html (July 12, 1999); Lock (1999). The controversy is covered in a special issue of *Cultural Survival Quarterly* (1996). On Carol Jenkins' research see "Medical Anthropology in the Western Schrader Range, Papua New Guinea" (1987).

patent-holder. Scientific objectification of the bodies of indigenous people has occurred for centuries, but generally any collected material has either gone out of circulation (often into museums) or, as in the case of kuru, become part of a scientific exchange regime. Now, however, governments and corporations—the new medical-industrial complex—can designate brains, blood, cells, and DNA as intellectual property, and having thus "immortalized" these body parts, they can trade them as commodities in a global market.Implicit in this essay is a methodological argument. I believe that we need to develop more locally specific models of the scientific exchange of gifts and commodities, to consider further the social life and moral weight of scientific things, and to document the cultural differentiation of scientific artifacts, rather than generalize about the global economy of science. But an emphasis on local knowledge should not be taken to deny the importance of global structures and systems. Instead, it challenges us to try to understand global science as a series of local economic accomplishments.[115] We need multi-sited histories of science which study the bounding of sites of knowledge production, the creation of value within such boundaries, the relations with other local social circumstances, and the traffic of objects and careers both between these sites and in and out of them.[116] Such histories would help us to comprehend the situatedness and mobility of scientists, and to recognize the unstable economy of "scientific" transaction. If we are especially fortunate, these histories will creatively complicate conventional distinctions between center and periphery, modern and traditional, dominant and subordinate, civilized and primitive, global and local.[117]

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[115] See also MacLeod (1987) and Chambers (1987).

[116] Marcus (1995). Multisited history is not the old comparative history, which tended to produce more systemic (and less interactive) comparisons. I am suggesting a series of microhistories connected by the passage of objects and careers. See Levi (1991, 95).

[117] See Nader (1996).

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