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**A SPONGIFORM ENCEPHALOPATHY OUTBREAK:
ANTHROPOPHAGY OR NOT?**

by

Mani Vessal

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Master of Arts

Department of Anthropology

Carleton University

Ottawa, Ontario

June 28/1999

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**A Spongiform Encephalopathy Outbreak:
Anthropophagy or Not?**

submitted by Mani Vessal, B.A..

in partial fulfilment of the requirements for
the degree of Master of Arts

Thesis Supervisor

Chair, Department of Sociology and Anthropology

Carleton University
August 19, 1999

Abstract

Since the Kuru endemic among the Fore Papua New Guinea, there have been numerous theories proposed to explain the mode of transmission of the agent responsible for the spread of this fatal neurodegenerative disorder. The “cannibalism” theory proposed by S. Lindenbaum and C.D. Gadjusek in the 1960's is now universally recognized. Due to the lack of evidence for the alleged cannibalistic practices by the Fore, this theory has been challenged in this thesis and an alternative model is proposed. Borrowing from L. Steadman’s hypothesis, the new model is further strengthened through the aid of the “prion theory”, epidemiology, and a comparative analysis of the mortuary practices of Kukukuku (Anga) and Baktaman, two relatives of Fore’s linguistic stock, to gain a better understanding of Fore’s funerary customs, and to examine the relationship between these customs to the spread of Kuru.

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Chapter 1: Introduction

Medical anthropology is a young sub-discipline of anthropology which is still in its developing stages. Beginning in the mid 1960's this discipline began to take shape when a number of anthropologists developed an interest in an aspect of anthropology which had never been before explored. This emerging discipline was not accepted immediately; as a consequence of being new to the world of academia, medical anthropology did not receive the respect that it deserved and faced many criticisms. Today over thirty years later, credence has been given to this sub-discipline, and it has become a significant focus of both anthropology and medicine. Increased specialization of the field is exemplified by the fact that medical anthropology has been further divided into micro level specialties such as neuroanthropology. This specialization enables one to explore a neurological problem by using the tools of both medical neurology and anthropology. Among the many neurological disorders that exist today, Kuru¹ makes an interesting case to explore from a medical anthropological perspective.

Kuru is found in only one region of the world in a small area of the eastern highlands of Papua New Guinea (Figure 1). In the late 1950's, D. Carleton Gadjusek, a prominent virologist became informed about a new mysterious outbreak of a deadly

¹ One of the spongiform encephalopathies (Prion diseases) which will be discussed in detail in chapter 2.

Figure 1. Map of Fore, Papua New Guinea

disease in the Fore region of Papua New Guinea. Gadjusek carried out extensive research on what became classified as a neurodegenerative disorder and published numerous articles concerning different aspects of the disease. Gadjusek's holistic methodology was illustrated by the fact that he not only studied the genetics and the molecular aspects of the disease, but he also included the cultural context upon which the disease depended within the scope of his inquiry. As reflected in a statement made by one of his colleagues, Gadjusek was known to be exceptionally brilliant, and extremely goal oriented:

...he had an intelligence quotient up in the 180's and the emotional immaturity of a 15-year old. He is quite manically energetic when his enthusiasm is aroused, and can inspire enthusiasm in his technical assistants. He is completely self-centred, thick-skinned, and inconsiderate, but equally won't let danger, physical difficulty, or other people's feelings interfere in the least with what he wants to do ...he has an obsessional interest in children...and he can live cheerfully in a slum or a grass land. (Burnet, 1971)

This description is quite revealing and sheds some light on why Gadjusek was so intrigued and persistent in his investigation of the disease. Realizing the research opportunity surrounding the Kuru disorder, Gadjusek seized it immediately.

Following twelve months of extensive research, Gadjusek and his colleague, Shirley Lindenbaum, reached a conclusion concerning the origin and spread of Kuru among the Fore people. As Lindenbaum wrote in her book: *Kuru Sorcery*, "Western scientists now consider Kuru to be a slow virus infection spread by the ingestion of human flesh" (Lindenbaum, 1979). This theory however was proposed following a

number of long debated proposals concerning the origin and the mode of transmission of Kuru. The three hypotheses were: i) Kuru resulted from the transmission of a virus from an animal or a plant; ii) modification of a known virus into Kuru; and iii) a sporadic case of Creutzfeldt-Jacob Disease (CJD) in the Fore area which given the opportunity for transmission in an unusual cultural setting, resulted in Kuru.

Although not completely ruled out, the possibility of the involvement of an animal or a plant vector seemed unlikely to Gadjusek. The second hypothesis was dismissed when the laboratory tests on the Kuru victims' brains revealed no resemblance with a known virus. Given the resemblances between Kuru and CJD, the third hypothesis seemed to be the most plausible explanation and therefore gained the favour of Gadjusek and his colleagues. Even though the third hypothesis explained the origin of Kuru among the Fore, the transmission of this disease at such endemic proportions was still a mystery. Thus both Gadjusek and his colleagues such as Zigas suspected a genetic susceptibility of the Fore which in turn isolated this group of people from their neighbouring tribes as well as the rest of the world. The distribution of the disease was remarkably skewed towards the adult female population with a ratio of 15 females to every 1 male, and an equal distribution among the children of both sexes. This posed a problem for Gadjusek and Zigas since the genetic hypothesis failed to explain this unbalanced transmission in the Fore region. Therefore, if the genetic predisposition was a factor in the spread of Kuru, it would have had to operate in conjunction with some other unknown elements. Clearly, the cannibalism theory

proposed by S. Lindenbaum would have accounted for such ambiguities. In fact this point of view is now universal with a few exceptions; namely the view of Lyle B. Steadman and W. Arens who argue against the cannibalism theory². Steadman suggests an alternative point of view which will be discussed in further detail in this thesis. Furthermore, with the aid of some epidemiological concepts as well as the prion theory³, a new hypothesis will be proposed which will account for both the transmission and the spread of Kuru among the Fore people.

The purpose of this research project will be to investigate the transmission of Kuru among the Fore of Papua New Guinea, in order to enhance our understanding with regards to the transmission and spread of this fatal disease. This will be accomplished through several analyses, first, the existing theoretical paradigms will be reviewed in detail and critically examined. In the final stage, a new model will be introduced which suggests an alternative view on the spread of this disease. The central objectives of this thesis will be:

1. To examine the molecular biology of infectious agents.
2. To examine the neurophysiology of the prion diseases as well as their clinical features.
3. To review some of the existing theories on the nature of 'ritual' as well as the purpose of cannibalism.

² Gadjusek and Lindenbaum's theory with regards to the transmission of Kuru in the Fore will be referred to as the cannibalism theory in this thesis.

³ Refer to section 2.10, chapter 2.

4. To assess the validity of the presence of cannibalism ethnographically among the Fore and neighbouring tribes
5. To critically review Gadjusek's theory on the transmission of Kuru in the Fore region of Papua New Guinea.
6. To re-examine Steadman's anticannibalism theory and to propose a linear model for the transmission and spread of Kuru through the basic epidemiological concepts as well as the present knowledge of the prion diseases.

Chapter 2 will provide a general overview of the biological mechanisms involved in the invasion of infectious agents such as viruses, as well as the nature of the prion diseases. Chapter 3 examines a number of different theories with regards to the nature of cannibalism and its function in a given society. Chapter 4 examines the cultural setting of the Eastern Highlands of Papua New Guinea, placing the mortuary practices of the Baktaman and the Kukukuku (ANGA) in the focus of the inquiry. Furthermore, a new model for the transmission and spread of Kuru among the Fore will be introduced. In the concluding chapter (5), an overview of the present and the proposed hypotheses will be made.

Chapter 2: Epidemiology of Infectious Agents & The Neurophysiology Of The Prion Diseases

2.1: Classification of Animal Viruses

Viruses have an enormous impact on humans and other organisms; despite their simple acellular organization, they play a very important role in the lives of millions of humans and other living organisms around the world each year. Viruses are infectious agents whose structures and modes of reproduction are very simple. A mature virus particle or *virion* consists of one or more molecules of DNA or RNA within a coat of protein (Prescott et al. 1990). There are three criteria which set viruses apart from living cells: I) their simple acellular organization; ii) the absence of both DNA and RNA in the same virion, and iii) the inability to reproduce independently of host cells and carry out mitosis as both procaryotes and eucaryotes do. However, under the optimal conditions when a host cell is present, the virion can replicate just as successfully as any other living procaryotic or eucaryotic cell. Virions range in size from 10 to 300-400 nm in diameter, where the largest viruses are the size of the smallest bacteria and thus can be seen under the light microscope. Most viruses however, are too small to be seen by the light microscope and are visible only through scanning and transmission electron microscopes (Raven & Johnson, 1992).

There are two phases in which viruses can exist: the extracellular and intracellular. In the extracellular phase, virions possess few if any enzymes and are unable to reproduce in the absence of their living host cell. The intracellular phase, in

contrast, involves the replication of virion nucleic acids which in turn diverts the metabolism of the host cell to produce immature virus particles leading to the release of complete virion particles (Prescott et al, 1990).

Reproduction of animal viruses can be divided into five stages: I) adsorption to the surface of the host cell, ii) penetration and uncoating, iii) replication of virus nucleic acids, iv) synthesis and assembly of virus capsid⁴ and v) release of mature viruses (Raven & Johnson, 1992). Adsorption occurs through a random collision of a virion with a plasma membrane receptor site. This is a crucial step because the ability of a virus to infect a cell depends heavily on how well it can bind to the surface of the host cell. Once bound to the cell surface, the penetration of the host cell plasma membrane occurs followed by the virus uncoating, removal of the capsid and release of viral nucleic acids into the cytoplasm where proviral DNA is synthesized and integrated with the host cell chromosome. Capsid proteins are then synthesized which in turn are self-assembled to form the capsid. Although the mechanism of virion release differs between naked⁵ and enveloped⁶ viruses, the end result is the same: naked virions are released by host cell lysis, whereas enveloped viruses are released

⁴ A protein coat which protects viral genetic material and aids in its transfer between host cells.

⁵ viruses that lack an outer membranous layer surrounding the nucleocapsid are referred to as naked virions.

⁶ viruses with an outer membranous layer surrounding the nucleocapsid; enveloped viruses have a roughly spherical but variable shape.

via membrane budding, thereby allowing the host cell to continue virion release for some time (Prescott et al, 1990).

Many viral infections such as influenza are acute infections with a rapid onset and short duration, whereas a number of viruses cause chronic infections lasting for years. Viruses may reproduce very slowly and it may take a few years before the symptoms develop.(Herpes simplex virus is a good example of a latent virus infection) A number of slow viruses may not be normal viruses at all; Scrapie, Creutzfeldt Jacob disease and Kuru are the best known and studied examples of such infections. These diseases are caused by simple, "nonviral" agents called prions which in turn deteriorate a specific region of the brain thus causing neurological deficiencies followed by death.

In this chapter, an overview of the nature and mechanisms involved concerning the transmission of viruses in the central nervous system is presented. Also, a review of the prion diseases such as CJD, Gerstmann-Straussler-Scheinker Syndrome (GSS), and kuru is made with a specific focus on the neurophysiology of these diseases. Finally, the existing theories surrounding the infectivity of the prion gene (PrP^{sc}) are critically examined.

2.2 Entry of Viruses

Animals are equipped with a number of barriers to prevent the entry of viruses from the environment. The most extensive barrier is the skin because the intact epidermis is covered by a layer of dead keratinized cells that can not support virus replication. Thus entry of a virus particle through the skin requires a mechanical

manipulation such as a cut, or animal bite (Johnson, 1982). In contrast to the epidermal cells, naked cells are exposed on the mucous membranes of the respiratory, gastrointestinal, and genitourinary tracts, which allows easy viral manipulation of the host. The gastrointestinal tract provides a harsh environment for most viruses. The extreme acidity of the stomach can inactivate most swallowed viruses where the gastric enzymes disrupt envelopes and capsid proteins, and bile can dissociate the lipoprotein membranes of enveloped viruses. However, there are a number of viruses such as the adenoviruses and enteroviruses that are adapted to replicate within the gastrointestinal tract (Johnson, 1982). Almost all the viral agents discussed above have the potential to invade the central nervous system (CNS).

Various studies have been performed since the 1920's surrounding the potential pathways a virus can take to infect the CNS. In addition, experiments on rabies, herpes simplex, and the polio virus suggest that all viruses are spread to the CNS along axonal, peripheral, hematogeneous, or olfactory nerves (Friedemann, 1943). Although there are a number of defence mechanisms protecting the host's CNS from virus invasion, viruses having the potential to cause CNS disease are common. The alveolar, epithelial, and subcutaneous phagocytic cells engulf and sometimes inactivate virus particles. Interferon is produced by infected cells, and the virus particles are cleared from the blood by the reticuloendothelial system, as well as the anatomical structures of the brain itself which deter viruses (Johnson, 1982). A schematic

Figure 2.1. Pathogenesis of CNS Infection. (Adapted from Johnson, 1982)

representation of the hematogenous spread of a virus into the CNS is shown in Figure 2.1.

Regardless of the path through which a virus reaches the CNS, disease can only occur if the virus particle is spread within the CNS, thus attaching to, penetrating, and inducing changes in the susceptible host cells. Susceptibility is determined by the process of adsorption, penetration and uncoating. Given the intense specialization of the cytoplasmic membranes of neural cells, a great variation in their susceptibility to different viruses can be appreciated. The presence or absence of specific viral receptors on the host CNS cell surface is the first of many restrictions which determine CNS vulnerability. To be susceptible to any form of infection, a cell must be able to initiate the process of penetration via endocytosis, and uncoat the nucleoprotein coat of the virus, thus releasing the nucleic acids. Finally, the host cell must have the metabolic capacity to transcribe, translate and replicate the viral nucleic acids to produce the virions (Johnson, 1980). Therefore, the absence of any of the above functions makes the host cell immune to a viral infection.

As mentioned earlier certain animal CNS infections are nonviral, in other words, the infection is caused by an agent that is not a virus at all. Kuru, Creutzfeldt-Jakob disease (CJD), Gerstmann Straussler Scheinker (GSS) and Fatal familial insomnia (FFI) are the diseases that fall in this category. In the following section, the subacute spongiform encephalopathy (SSE) disorders will be discussed with an specific emphasis on Kuru, and CJD from a neurophysiological perspective.

2.3: Subacute Spongiform Encephalopathy

Subacute spongiform encephalopathy (SSE) refers to the characteristic cerebral disease in which a rapidly progressive dementia is associated with such symptoms as cerebellar ataxia, diffuse myoclonic jerks, and a number of other neurologic abnormalities. Since Kuru is one of the SSE diseases, the neuropathological changes are very similar. Changes to the cerebral and cerebellar cortices result in neuronal loss and gliosis accompanied by a large vacuolation, thus giving the affected regions a spongy state (Adams et al, 1997).

SSE is frequently referred to as Creutzfeldt-Jakob disease (CJD). However, recently there has been a debate on the neurophysiological and neuropathological nature of CJD and its resemblance or lack thereof, to SSE. Apparently the disorder described by Creutzfeldt and Jacob has been confused for two completely different disorders : Subacute myoclonic dementia (Heidenhain disease), and SSE, which is now known to be an infection caused by a transmissible agent (prion). Some neurologists however, argue that CJD shares little if any resemblance to SSE, and it is contended that the two disorders should be kept completely separate⁷. CJD occurs in all parts of the world with no seasonal preference, with an annual rate of incidence of 1-2 cases per million of population. Studies have shown that the incidence is higher in Israelis of Libyan origin, in immigrants to France from North Africa, and in Slovakia, for reasons that will be discussed in the following sections (Adams et al, 1997).

⁷To avoid any confusions, CJD and SSE will be used interchangeably in this thesis.

2.4: The Clinical Features of SSE

Transmissible SSE generally occurs among the late middle age group with no sexual preferences. In the prodromal stage, the initial symptoms include: fatigue, depression, weight loss, and disorders of sleep and appetite which could last for weeks. The early stages of the disease are marked by constant behaviour changes at both the emotional and intellectual level in addition to visual impairment. Also, at the early stages, symptoms of confusion, hallucinations, delusions, and agitation are experienced quite frequently (Adams et al, 1997). The progress of this disease is alarmingly aggressive; deterioration is evident daily, eventually leading to the myoclonic contractions of different muscle groups. Myoclonic jerks are evoked by any sensory stimuli such as a loud sound or bright light, but can occur spontaneously as well. Twitching of the fingers, ataxia, and dysarthria are also prominent features of this disease. The pathology of SSE is nearly identical to that of kuru in that the cerebral and cerebellar cortices are almost exclusively affected by the disease. Also, microscopic studies reveal heavy vacuolation giving the diseased brain its spongy appearance. Although no cure is available, specific precautions can be taken to prevent the transmission of the disease. The transmissible agent is resistant to boiling, formalin and alcohol treatment, and U.V. radiation, but can be destroyed by autoclaving at 132 C and 15lb per square inch for 1 hour, or by immersion in 5% sodium hypochlorite for 1 hour, and 96% formic acid (Taylor, 1991). Also, as outlined by Brown et al (1990), those performing autopsies or brain biopsies on SSE patients

should take special precautions⁸ for the following reasons:

- i- The disease is transmissible between humans and thus hazardous to workers (ie: pathologist, laboratory staff, neurosurgeons).
- ii- All the studies indicate that the infective agent is concentrated in nervous tissues, including cerebrospinal fluid (CSF) and lymphoid tissues.
- iii- The infective agent is resistant to most of the disinfecting products.
- iv- The agent is extremely persistent in the environment.

The close relationship between CJD, kuru, GSS, and FFI, as transmissible neurodegenerative diseases is emphasized by spongiform change, neuronal loss, reactive gliosis and amyloid plaque formation, all of which are pathological hallmarks of these diseases (Masters & Richardson, 1992). The nature of the infectious agent in this group seems to stem from the abnormal isoform of the human prion protein (PrP) which is related to the infectious agent, and primarily accumulates mostly as amyloid plaques in the human CNS (Doerr-Schott *et al.*, 1990). Several genetic abnormalities on chromosome 20 of the human PrP gene have been identified. Such abnormalities are not necessarily confined to the typical cases of spongiform encephalopathies, but rather cases of 'atypical' dementia with no sign of spongiform change, amyloid plaques or gliosis can be present.

Microscopic examination of the CJD brain may not reveal any spongiosis and

⁸One neurosurgeon is known to have acquired SSE via performing a biopsy on a SSE patient.

seem quite normal in cases with short clinical history, however cortical atrophy⁹ is generally present involving any of the frontal, temporal, or occipital lobes (Bastian, 1991). In severe cases where the deep gray matter structures are atrophied, the brain can weigh as little as 1000g. As it might be expected, the neuronal loss is extensive in cases with prolonged clinical history, consequently leaving the cerebral cortex with only a few residual nerve cells. These surviving cells generally show abnormalities in their structure, especially in their dendritic pattern, as well as the presence of neurofibrillary tangles found in Alzheimer's disease¹⁰, and ballooned neurons in the cerebrum and cerebellum (Kim & Manuelidis, 1989). Also, neuroanatomical studies have shown that the deep gray matter structures such as the caudate nucleus and putamen are affected more severely than the globus pallidus (Fig 2.2) (Masters & Richardson, 1978). In addition to the structural changes of the gray matter, spongiform change and gliosis have also been reported in the subcortical layers of the cerebral white matter.

2.5: Neurophysiology of Kuru

Since the outbreak of Mad Cow disease, there have been new theories formulated to explain the origin of the virus causing the Mad Cow disease. The

⁹Cortical atrophy refers to the reduction of the brain size, in this case the cerebral cortex.

¹⁰Neurofibrillary tangles formed by the beta-amyloid plaque are the neuropathological hallmark of Alzheimer's disease, which is also used in its diagnosis.

Figure 2.2: Dopaminergic tracts in the brain: anatomical representation of Caudate nucleus, Putamen and Globus pallidus (Adapted from Kandel, ER; Schwartz, JH, and Jessel, TM, 1991).

popular theory proposed in the early 1990's is the prion (proteinaceous infectious particle) theory. The prion theory suggests that there is a mutation of a normal protein in the victim's brain, since the normal protein is not infectious, thus, transforming the protein from a 'normal' type to an abnormal form (Prescott *et al*, 1990). This viral mutant would then replicate and eventually take over the entire brain. Human prion diseases include Creutzfeldt-Jacob disease, Gerstmann-Strausler-Sheinker disease (GSS), fatal familial insomnia (FFI), and Kuru. Although, each of these diseases has a specific clinical presentation, spongiform encephalopathy, neuronal loss, and gliosis are their neuropathological hallmarks. The prion theory will be discussed in further depth, in the following chapter.

As mentioned earlier, Carleton Gadjusek drew parallels between the practice of cannibalism and the transmission of Kuru. However, this cannibalism theory was proposed prior to the introduction of the prion theory, thus, neither Gadjusek nor any of his colleagues were aware of such a mechanism. Kuru, as with CJD, presents a very characteristic physiology. Neuropathological examination of the patients infected with any of the prion diseases reveal severe spongiform change and neuronal loss in the deep cortical layers, and the putamen (Figure 2.4). In addition, the putamen and cerebellum are the two areas most acutely affected by the prion protein mutation (Nitrini *et al*, 1997).

The affected area of the brain accounts for the characteristic clinical features of the kuru victims. In order to understand the importance of the putamen and the

Figure 2.3. Schematic representation of Basal Ganglia in relation to surrounding structures. (Adapted from Kandel, ER; Schwartz, JH; and Jessel, TM, 1991).

cerebellum, their anatomy and physiology should be briefly reviewed (Figure 2.3).

Cerebral hemispheres form the largest region of the brain.¹¹ They consist of the cerebral cortex, the white matter, and the three deep nuclei: the basal ganglia, the hippocampal formation, and the amygdala (Kandel et al, 1991). Voluntary movements depend on integration of the motor and the sensory systems. The cerebellum and the basal ganglia play an important role in motor integration by receiving sensory input and modulating the timing of movements (Kandel et al, 1991). Thus, these structures are essential for a smooth and accurate execution of movements. The basal ganglia is composed of three components: the caudate nucleus, the putamen, and the globus pallidus (Fig 2.2). The caudate nucleus and the putamen are together termed the corpus striatum and are involved in regulating the speed of movements and cognition (Kandel et al, 1991). Lesions to either the cerebellum or the basal ganglia result in characteristic movement disorders as discussed for kuru (refer to clinical features). Consequently, damage to the cerebellum results in a delay in the onset of movements, and damage to the basal ganglia slows voluntary movements and often results in uncontrolled, involuntary movements.

2.6: Kuru: The Clinical Features

Among the Fore, Kuru means trembling or fear. Kuru is marked primarily by symptoms of cerebellar dysfunction such as loss of balance, ataxia (incoordination),

¹¹The six main regions of the CNS are: the spinal cord, medulla, pons, midbrain, thalamus and hypothalamus, and the cerebral hemispheres.

and tremor. The initial shivering tremor usually progresses to complete motor incapacity, and death, in about a year after the contraction of the causative agent (Hornbrook, 1976). Females are the initial victims of this disease, followed by children¹². A few weeks into the infection, control over involuntary body movements becomes a struggle, eventually leading to complete physical incoordination where death becomes inevitable (Lindenbaum, 1979).

Clinical advancement of Kuru is remarkably uniform and it is divided into three stages by Gadjusek. The first or 'ambulant' stage is usually self-diagnosed before others in the community are aware that the patient is ill. There is an unsteadiness of the posture, often the voice, and hands, and crossing of the eyes (Gadjusek, 1963). Body tremors while walking and ataxia are the first signs, initially no different from those of hypersensitivity to cold (shivering). Dysarthria (slurring of speech) starts early and gets progressively worse as the disease advances. Strabismus or crossed eyes often appears and persists. The lower extremities are affected by incoordination before progressing to the upper extremities. Very early in the disease, the inability to stand on one foot for many seconds is a helpful diagnostic clue (Gadjusek, 1965). Gadjusek also noted in his field notes that in the latter half of its first stage, patients usually manoeuvre about the village with the aid of a stick.

The secondary or 'sedentary', stage is reached when the patient can no longer walk without complete support. The tremors and ataxia become very severe and

¹² Refer to the second half of pg.4.

Figure 2.4. Neural representation of the Primary, Secondary, and Tertiary stages of the Kuru infected Cortex. (Adapted from Raven and Johnson, 1992)

consequently, the limbs become rigid due to the repetitive muscular spasms. The muscle spasms are the result of constant involuntary, irregular, and sometimes shock-like movements which are largely caused by sudden exposure to noise or bright light (Gadjusek, 1965). Emotional instability leading to outbursts of laughter are quite frequent in the first half of this stage¹³, but smiling and laughter gradually cease as the disease progresses (Figure 2.4).

The third or 'terminal' stage, is reached when the patient is unable to sit up without support, and ataxia, tremor and dysarthria become so severe that the patient is totally incapacitated (Gadjusek, 1965). The final clinical feature of this disease is characterized by the inability to retain urine and faeces, and finally dysphagia (difficulty swallowing) leading to thirst and starvation (Gadjusek, 1965). Deep skin ulcerations over the bony areas and pneumonia appear in the terminal stages leading to death.. Occasionally, death occurs fast enough so that the patient is still well nourished and thus does not starve.

The infected brain, upon examination, gives a normal external appearance. However, microscopic examination reveals widespread neuronal degeneration and the development of vacuoles around neurons; the latter giving the gray matter a sponge-like quality¹⁴ (Beck et al, 1969). Within the spongy areas there is neuronal loss, and

¹³Since frequent outbursts of laughter are associated with Kuru, this disease is sometimes referred to as the 'laughing disease'.

¹⁴ Refer to Figure 2.4, the tertiary stage.

surviving nerve cells showing various forms of degenerative change (Beck *et al.*, 1969). Microscopical examination has also revealed a very severe loss of granule cells with less marked loss of Purkinje cells, although the latter cells show abnormal dendritic swellings. One interesting observation made by Gadjusek and his colleagues is that the kuru agent is very thermostable, in other words, the infectious agent remains stable over several months and even years when stored at -70 C. In addition, the infectivity of the kuru agent is not significantly reduced following its exposure to a temperature of 85 C for over 30 minutes (Gadjusek, 1961). Due to the timing of the disease, the vacuolization of the gray matter, and the location of the destructive effects in the body, kuru is referred to as a subacute spongiform encephalopathy¹⁵ (Merbs and Steadman, 1982).

2.7: Creutzfeldt-Jakob disease (CJD)

CJD occurs at a rate of about 1 case per million per year. Studies have shown that this diseases occurs throughout the world and the incidence in individual countries is independent of both incidence of scrapie and sheep population (Masters *et al.*, 1979). Evidence from transgenic models has shown that the transmissible agent responsible for CJD lacks nucleic acids and as Prusiner (1991) puts it: “may be a novel biological phenomenon in the form of a self-replicating protein”. The epidemiological studies of CJD reveal no evidence of spatial clustering of the disease, thus emphasizing the improbability of case to case transmission (Harries-Jones *et al.*, 1988). Consequently,

¹⁵Refer to SSE section of this chapter

close contact with the infected patients can not be a risk for developing the disease and the spouses of sporadic cases are not at any greater risk than the general public for developing the disease. Although CJD is not specific to any specific region of the world, molecular biological studies indicate that there is a 60-100 fold increase in incidence of CJD in Slovakia and Libyan born Israelis which is probably due to the high rate of prion protein (PrP) gene mutation (Mitrova & Bronis, 1991).

There are three different types of CJD: familial incidence, sporadic, and iatrogenic transmission. As mentioned earlier, the familial type is closely related to the mutations of the PrP gene and not to contact transmission. Contrary to what some critics may argue, the high incidence of CJD in Slovaks and Israelis born in Libya is due to a high frequency of the codon 200 mutation of the PrP gene (Brown *et al.*, 1991). The sporadic case of CJD is speculated to be due to the spontaneous occurrence of a self-replicating protein, probably by somatic mutation¹⁶ (Hsiao & Prusiner, 1990). The iatrogenic transmission of CJD which is the accidental transmission of the infectious agent from person to person occurs through direct or indirect contact with contaminated material. "Central" or direct inoculation can occur during neurosurgery, depth electrodes, corneal or dura matter graft, having a mean incubation period of 2 years which results in disease. Indirect or "peripheral" inoculation can occur through human pituitary derived growth hormone (hGH) or

¹⁶A mutation occurring in a somatic cell. A somatic cell is a "body cell", whose genes will not be passed on to future generations.

pituitary derived gonadotrophin (hGnH) which also results in disease, occupying a longer mean incubation period of about 12 years¹⁷ (Brown et al, 1992).

In order to differentiate between spongiform encephalopathies and some other neurodegenerative disorders such as Alzheimer's disease, where neurofibrillary tangles are also present, advanced biomolecular techniques such as silver staining or immunocytochemistry are used. These allow for a more thorough identification of the disorder. For example, cases of human spongiform encephalopathies may be confirmed by a positive immunocytochemical staining of PrP deposits in the amyloid plaques. therefore, the diagnostic confusion with Alzheimer's disease can be clarified (Probst et al, 1991).

Recent studies on CJD have revealed a new alternative mode for the transmission of this disease. Maura Ricketts and Neil Cashman (1997) and their colleagues from the CDC¹⁸ and Montreal neurological institute respectively have carried out a study which examines the possible role of blood in the transmission of CJD. Successful transmission of CJD through the injection of contaminated blood from infected human patients directly into mice brains has been demonstrated. Although transmission of this disease has also been accomplished via the peripheral inoculation (ie: blood cells) with an incubation period analogous to central transmission, the results however are not as predictable as the central inoculation

¹⁷ Refer to table 1, chapter 4.

¹⁸Centre for Disease Control, Health Canada.

(Tateishi, 1985). The difficulty in infecting peripheral cells is probably due to the structural differences between peripheral and the central PrP. Even though human case studies have not shown a direct link between patient infection with CJD through blood transfusion, indirect cases indicate a probable connection.

2.8: Gerstmann-Straussler-Scheinker syndrome (GSS)

Following the identification of CJD in the early 1920's, the next piece of the puzzle was revealed. In 1936, Gerstmann, Straussler and Scheinker described a familial disorder with clinical signs of cerebellar abnormalities such as speech difficulties and weakness of the limbs (Hsiao *et al.*, 1990). The most striking physical characteristic of this disease at the cellular level is the accumulation of the amyloid plaques both in the cerebellum and cerebrum as well as spongiosis. Because of the spongiform changes, this disorder is also classified under the spongiform encephalopathies in humans. GSS is generally involved with a mutation at codon 102¹⁹ which results in the PrP amyloid plaques (Bugiani *et al.*, 1993). It is presumed that a number of GSS cases in the past have been diagnosed and reported as familial Alzheimer's disease, before such techniques as immunocytochemistry were available to differentiate between beta-amyloid plaques²⁰ and PrP amyloid plaques (Hart &

¹⁹A proline-leucine change at codon 102 occurs, although there are exceptions where a mutation at codon 198 of the PrP gene can also lead to GSS.

²⁰The histopathological hallmark of Alzheimer's disease is the presence of beta- amyloid protein which results in plaque formations.

Gordon, 1990).

2.9: Bovine Spongiform Encephalopathy

Ever since the outbreak of Mad Cow disease in England in the 1980's, the European and the North American nations have paid closer attention to the prions and their deadly consequences on animals including humans. Although this worldwide attention has increased the general public's knowledge about transmissible spongiform encephalopathies, and consequently that of governments', more extensive research is required in order to find possible clues to solve the fatal transmissible spongiform encephalopathy (TSE) puzzle. The microscopic examination of those patients who lost their lives to CJD from Mad Cow, reveals more amyloid plaque formations in the affected regions of the brain than spongiform changes (Rhodes, 1997). Incidentally, such amyloid plaque formations further complicate the CJD diagnosis due to its molecular resemblance with Alzheimer's disease.

2.10: The Prion Theory

The transmissible spongiform encephalopathies (TSE) which include all the neurodegenerative disorders which were described earlier in this paper, appear to be related to a single cellular glycolipoprotein, presumed to be the proteinaceous infectious agent, and designated by Prusiner (1982) as the prion protein (PrP). One of the main reasons for this designation is to emphasize the fundamental difference between this type of an infectious agent and viruses and viroids mainly because of the absence of nucleic acids in the prion protein (Prusiner, 1989). The "protein only

Figure 2.5. Diagrammatic representation of A): "protein only model", and (B): "Virino model" (Adapted from Weissmann, C; Bueler, H, and Sailer, A. 1993)

hypothesis” proposed by Pruisner (1989), suggests that a normal host protein (PrPc) is modified from its normal state to a mutant type (PrPsc) (Figure 2.5A). The nature of this alteration, whether chemical or conformational, and the timing of the alteration are still unknown. PrPsc is a protease-resistant²¹ form of PrPc which accumulates intracellularly in cytoplasmic vesicles²². The “Virino hypothesis” suggests that the infectious agent consists of a nucleic acid genome specific to PrPc which replicates inside the cell (Kellings *et al*, 1992) (Figure 2.5B). However, due to the lack of credible evidence, this model can not be accepted. Therefore, the only plausible model available today for the physiology and the mechanism responsible for the infectivity of the prion protein and consequently the prion diseases such as CJD, GSS, FFI, and Kuru is Pruisner’s “protein only” model (Figure 2.5A).

As discussed in this chapter, the widely accepted mode of transmission and spread of Kuru as suggested by Gadjusek’s research identifies the disease with the practice of cannibalism. The next chapter will present an overview of the anthropology of anthropophagy within the ritualistic context. Furthermore, the present theories concerning the functional aspects of this ritual will be critically reviewed with an emphasis on Conklin’s (1995) case study on the Wari of Brazil and in order to contextualize the ritualistic importance of this ceremony.

²¹Resistant to protein breakdown which is normally done by lysosomes

²²Vesicles are the carriers in the cell that transport cellular waste and /or other materials such as receptor proteins back and forth to various organelles such as lysosomes and plasma membrane.

Chapter 3: Different approaches to the study of “ritual” and the practice of cannibalism

Since Durkheim, the concept of ritual has held a privileged position in studies of social life because investigators recurrently have treated it as a source of insight into core issues of human sociality, such as the maintenance of social order

(Roth, 1995)

Historically there have been many different theoretical perspectives which have undertaken the study of ritual. Studying what many consider to be impoverished cultures, anthropologists from the West have been particularly fascinated by the “exotic other” where ritual drama is central rather than peripheral for their informants. Thus the key issue in understanding ritual lies in how this phenomenon is defined. Ritual is analysed and broadly defined by different scholars ranging from Van Gennep’s “rites of passage” (Van Gennep, 1960), to Goffman’s “rules and practices of co-mingling” in an every day public interaction (Goffman 1971). Given such broad and complex issues involved with the concept of ritual, there is a greater need for the analysis and understanding of this phenomenon. According to Roth, there are two main issues that the researchers face when analysing a given ritual: I) to identify an activity as ritual and ii) to describe the nature of that ritual. As stated by Roth (1995), there are three basic approaches which analysts consider to identify, describe, and analyze ritual. These three approaches which are phrased in the form of questions are: i) “is ritual described from a solidaristic or an agonistic perspective?”, ii) “is ritual action described from a compositional or a functional perspective?” and iii) “is ritual

identified as an aspect of action or a type of it?" (Roth, 1995).

Since only the first two of the above mentioned approaches are relevant to ritualistic cannibalism or endocannibalism, a brief discussion of these two questions will be presented. In addition, cannibalism will be examined from the endocannibalistic perspective using Beth Concklin's ethnography on the Wari of Brazil.

3.1: Solidaristic vs. Agonistic perspective

The solidaristic model treats ritual as a unifying mechanism for social integration. In other words, through a shared set of beliefs among a given population, ritual helps to unite the 'actors' in a society. Funerary practices are one of the best examples of the solidaristic perspective, since it acts as a unifying event for the family and friends of the deceased. The agonistic perspective on the other hand treats ritual as a stratifying experience, where human emotions are manipulated by imposing patterns and routine in their life (Roth, 1995). Using the funerary practices once again, the agonistic model argues that the more financially stable a family is, the more elaborate their funerary ritual. Thus, according to this perspective, not all individuals have an equal experience during this ritual. Consequently, this can be a stratifying experience which only aids in sustaining the stratification of different classes.

3.2: Is ritual action described from a compositional or a functional perspective

The compositional approach concentrates on the 'structure' of the constituents of a ritual. The functional perspective on the other hand views ritual in a more general

approach with a particular emphasis on its social consequences (Roth, 1995). The compositional perspective concentrates on the actual process of a ritual and not on its meaning, as opposed to the functional approach which emphasizes the importance of the sociocultural context of ritual and the function that it serves in a given society. In general, the researcher either ignores the compositional perspective or subordinates it to the functional approach. Analysts dating as far back as the early nineteenth hundreds have proposed and studied the two approaches. Van Gennep (1908) who published "The Rites of Passage", stressed the compositional approach. On the other hand, a few years later, Durkheim's "Elementary Forms of Religious Life" emphasized the functional perspective.

According to Durkheim ([1912] 1965) 'rituals are a primary source by which humans- in relation to one another and their society -- define the sacred and thus, ultimately, society itself' (Roth, 1995). Victor Turner (1977), integrated both Van Gennep's compositional and Durkheim's functional perspectives by focusing on one specific element pertaining to the transitional process of ritual: 'liminality'. Turner recognized the three main processes involved in ritual: separation, transition, and integration, but concentrated on 'liminality' which according to him serves as the venue for transition. This stage places the 'actor' in an altered state of consciousness²³

²³ In the context of Western society an ASC is a state of consciousness other than the "normal" waking phase; also some anthropologists use alternative state of consciousness because altered implies 'abnormality'. Meditative, drug induced, trance, and dream states, are all examples of ASC.

(ACS) and serves as the best learning tool for a given ritual. Among the countless number of rituals that have been known and/or practised by different cultures, cannibalism has been one of the most studied and controversial customs.

3.3: Cannibalism

The ritual practice of cannibalism has been a contentious issue in anthropology and over the years there have been numerous theories which have attempted to explain its origin, and the motive(s) behind its practice among those cultures involved. Before exploring cannibalism and the issues pertaining to this mortuary practice, one thing should be clarified: what does cannibalism mean? For the intent of this thesis, cannibalism will be defined simply as the consumption of the human flesh by humans. Two forms of cannibalism have traditionally dominated: exocannibalism, and endocannibalism. The former definition refers to the consumption of an “outsider’s” flesh, and the latter refers to the ritualistic consumption of an individual within the group. Furthermore, while both exo. and endocannibalism share a common theme: consumption of the human flesh, there is a significant symbolic difference between the two practices. It is this symbolic significance which has generally been overlooked and this has contributed to the different opinions on this subject which have ultimately influenced the different theories concerning the significance of the practice.

The theoretical approaches vary a great deal, ranging from those which are blatantly ethnocentric, illustrating little if any understanding of the symbolic significance towards the practice of this ritual, to those theories which demonstrate

cultural relativism and sensitivity. Failing to make a distinction between endo and exocannibalism ethnocentric methodologies tend to ignore the cosmology of the cannibal societies which include: grieving, social bonding ties, human-animal reciprocity, and views toward the corpse. In this section I intend to explore the existing hypotheses and theories on cannibalism with a specific emphasis on endocannibalism and the logic and rationale behind this practice.

One of the most biased conclusions ever made by anthropologists and other scientists with regards to cannibalism is that it is a barbaric ritual, one which is only practised by the 'uncivilized' and 'primitive' cultures. Although this mode of thinking was more prevalent two decades ago than it is now, nevertheless, some academics still cling to this position. The universalist theories of cannibalism have the tendency to view anthropophagy as merely an antisocial act which in turn stems from the agonistic perspective. This is further emphasized by the recent anthropological theories which also identify this ritual with antisociality and the focus leans toward exocannibalistic practices rather than endocannibalism (Conklin, 1995). Other theories such as the psychogenic theory add an even more bitter flavour to anthropophagy. Theorists such as Freud and Sagan have viewed cannibalism as an expression of an "individuals egocentric, oral aggressive impulses" (Sagan, 1974). Lewis (1986) also refers to both types of this practice; exo, and endocannibalism as an oral and genital aggression, and agonistic desires for dominance. Once again, all the above theories, regardless of their credentials, have concentrated on the aggression or antisociality of cannibalism which

have been in turn drawn from the exocannibalistic behaviour. Evidently, none of the above theories have made any reference to endocannibalism. One possible explanation for this is the theorists' mode of thinking; in other words, one common theme shared among the hypotheses mentioned earlier is the use of the condescending tone towards the studied cultures. Thus, no consideration has been awarded to the cultural mourning practices, rituals or customs exercised by the natives in the explored societies, practises characteristic of endocannibalism.

Examining the literature on cannibalism, it becomes evident that the exocannibalism of the enemies of a given tribe or society is the most popular topic and one which dominates the ethnographies. Consequently, exocannibalism has been reported more frequently, and explored in more depth than endocannibalism. Thus, less emphasis has been placed on the mortuary side of this practice and the fact that this practice is located within an institutionalized ritual context. Although scarce, I was able to find one study which had actually concentrated on cannibalism from the endocannibalism perspective. Even though this study by Beth Conklin (1995) examined mortuary cannibalism in an Amazonian society (Wari of Western Brazil), as opposed to Papua New Guinea, the symbolic significance behind the practice however, is quite similar universally. In her discussion, Conklin presents cannibalism from the natives' perspective, emphasizing the key societal role of this practice among the Wari. Among the Wari this ritual functions as a fundamental link to all other social ties and activities in the community. Conklin's article is one of the very few

papers ever written on this subject from the emic perspective, thus reducing the bias in her report. Recent theories of mortuary cannibalism have concentrated on only a limited range of cultural motives. According to Conklin, two main ideas are shared by all the cannibal societies: one is that cannibalism benefits only those who consume the flesh, and secondly, vital energies are transferred via this practice. It is believed that such vital energies and body substances are contained in the corpse and once consumed, they will be transferred to the living person's body and thus their energy will carry on. As Sanday (1986) points out "endocannibalism regenerates and recycles social forces that are believed to be physically constituted in bodily substances or bones". Similarly, Lewis who initially supported the antisocial theory, reports that "the ritual consumption of parts of human body enables the consumer to acquire something of the body's vital energy" (1986:73). Although, such interpretations do not fully apply to Conklin's case study on the Wari of Brazil, nevertheless, the Amazonian endocannibalism shares a similar ideology to other cultures which practice cannibalism in the world.

Conklin (1995) contends that there are three dimensions of a Wari individual's experience related to cannibalism: "social processes of mourning, body concepts, and the regenerative imagery of ancestor's transformations into animals". The above three concepts are interlinked and inseparable, thus, one cannot be discussed without reference to the other. As mentioned earlier, endocannibalism involves the consumption of a tribesman. In the Wari culture as with most other cultures who

practise endocannibalism, consumption of a close family member or anyone affiliated by blood is strongly forbidden. The reason for this taboo lies in the belief which suggests that eating a close relative is analogous to eating one's own flesh (autocannibalism), which is believed to be fatal (Conklin, 1995).

One major difference between the Western beliefs concerning mortality and that of the Wari and other endocannibals, is that the Western notion of death refers to a loss of consciousness which is accompanied by the departure of the person's soul or spirit, and what is left behind is a hollow shell. The Wari on the other hand, view the corpse as a symbol of identity and social bonds, which are in turn reaffirmed by the practice of cannibalism (Conklin, 1995). In other words, the dead flesh is not looked upon as a mere object, or a shell, but rather as a symbol of life and cosmic energies ready to be transferred to another human via cannibalism. By this process, the spirit or soul of the dead is lived on for eternity.

The final principal theory which has persisted for many years revolves around the notion of the human flesh as food. Harrison (1985), has proposed that cannibalism may have been motivated by a society's need for 'dietary protein'. Although this proposal was to explain Aztec human sacrifices, it could very well be argued for the Wari practices which involved the consumption of significant quantities of human flesh and ground bones. Undeniably, those who ingested these would have gained some nutrients; namely protein and calcium from the ingested meat and the ground bones. However, to argue that this alone is a sufficient motive for cannibalism is

quite absurd. For this notion to hold true, there must have been a shortage of food among the Wari and other cannibal societies. Upon examination of the precontact population, Conklin (1995) reports that the Wari, having a low population, controlled a large area with a sufficient supply of game, fish, and Brazilian nuts. Elders have attested that hunger was unheard of, and the missionaries present at first contact reported no signs of malnutrition²⁴. Conklin further adds her own data on household diets in two communities, indicating that current Wari diets are adequate. Another argument against nutritional motivation for Wari cannibalism is that much potentially edible flesh was burned rather than consumed and no attempts of its preservation for later consumption is observed. The 'protein deficiency theory' also fails to account for those societies which have experienced massive food shortages but never have resorted to cannibalism. In addition, other societies sharing the similar geographical situation with low protein supplies, still do not practice cannibalism. If it were so ecologically viable, then why doesn't every culture resort to cannibalism when protein is scarce.

In another study done by M. Dornetreich and G. Morren (1974), the question of nutritional value of cannibalism among the cannibals in the Papua New Guinea is examined. They have concluded that this practice does have nutritional value for certain human groups, specifically tropical peoples living at low-medium population

²⁴ This also applies to Gadjusek's bias with regards to protein deficiency among the Fore

densities. This conclusion is based on the assumption that while cannibalism has been reported for many different parts of the world, it is most common in the tropics where protein is 'known' to be in short supply. The authors however, have failed to explain for the absence of cannibalism among those cultures with similar geographical setting (ie: tropics) as discussed previously, thus little credence if any, can be awarded to this theory²⁵.

It appears as though the nutritional arguments stem from the cultural materialist point of view in which cannibalism is reduced into a demolishing act of human destruction whereby its only purpose is to diminish humans into plain meat, fat, bone, and protein. According to J. Friedman (1992): "To be consumed in such a context is not to be reduced but to be elevated, to be absorbed into the life of a superior".

In contrast to Sagan and Freud, it is safe to presume that cannibalism is a reaffirmation of the human-animal relationship, and an interdependency of human mortality and animal productivity. Also, the key idea among such societies is not the consumption of human flesh but rather the continuity of life after death and its social and psychological importance. Through this practice, the corpse becomes a central avenue through which the mourners' memories and emotions are relived. In addition, this ritual diminishes the process of grief for mourners, such that the loss is

²⁵ Marvin Harris the author of *Cannibals and Kings*, has also played an important role in order to explain the function of cannibalism, specifically the nutritional value of this practice.

experienced as an acceptance of death and the regenerative process since the deceased is revitalised and revived. Thus, by understanding the cosmological significance of cannibalism in a given society, the complexity of this ritual can be appreciated. As mentioned earlier in this chapter the underlying conviction for the practise of endocannibalism can be said to be universal and therefore the principal concepts of this ritual are shared among all the involved cultures. Consequently, examining the nature of endocannibalism practised by the Wari of Brazil can also shed light in our understanding of the cosmological effects that this ceremony can have on the participants of other endocannibal societies.

Due to the lack of sufficient evidence of the ethnographic data on the mortuary practices of the Fore of Papua New Guinea, I have had to steer my focus on the ethnographic data available for the neighbouring tribes of the Fore. In the following chapter, two of the Fore's neighbouring tribes will be studied carefully, placing their funerary practices at the centre of my inquiry.

Chapter 4: Baktaman and Kukukuku; a Closer Look At Their Funerary Rituals and a New Model for the Transmission of Kuru Using Epidemiology

Disregarding the usual methodological prerequisite of first-hand observation- enshrined in the Malinowskian fieldwork manifesto- our accounts of cannibalism all too frequently rely on second hand reports. Such lack of scholarly rigour regularly leads to confusion and conflation of this idea or ideology of cannibalism with its actual practice. Hence, many modern anthropological studies inadvertently tend to entrench and further legitimize deep-seated Eurocentric assumptions concerning the prevalence of cannibalism in tribal societies.

(Lewis, 1996:68)

Upon examining the literature, the lack of data concerning the ethnographic aspects of the Fore becomes evident. As for any society, death is acknowledged by elaborate ceremony in the cultures of highlands of Papua New Guinea, and the rites surrounding this phenomenon serve a vital function and are of a great importance. Fore, a region in the highlands of Papua New Guinea has been a topic of charged debate for the past four decades. The Fore includes a cultural group of about 15,000 inhabitants which belong to the Eastern Highland linguistic group, specifically those of the Anga and Pawaian stock (Wurm, 1964). The hamlets and villages of this tribe are situated at elevations of 3000-8000 feet on the steep forested mountains of the Eastern Highlands.

Ever since the outbreak of Kuru, this region has been veiled by a gloomy accusation which indicts the Fore for the act of cannibalism. This charge is the result of a theory which is recognized universally, in which the transmission of the Kuru agent was linked to the practice of cannibalism by Fore women during mortuary

rituals. This theory was first suggested by Shirley Lindenbaum and her colleagues in the hope of explaining the spread of this fatal disease in the Fore region. In addition to Lindenbaum, Dr. C.D. Gadjusek led a medical team to the Fore region, where he worked diligently in an attempt to unravel the mystery of this disease. Spending numerous months in the field collecting data via blood tests, autopsy samples of the victims' infected brains, and an overall analysis of the patients, Dr. Gadjusek supported Lindenbaum's hypothesis which recognized cannibalism as the only plausible explanation for the transmission of Kuru.

Although, Dr. Gadjusek's contributions to the understanding of this disease both at the molecular and at the clinical level have been paramount, his lack of formal training in the discipline of anthropology has contributed to the major flaw in his conclusions with regards to the cannibalism theory²⁶. Even though I cannot dismiss this theory, one thing that is evident to me is the inadequacy of support for the act of cannibalism in this region. In other words, there has never been a single first hand observation of this practice among the Fore, and both Lindenbaum's and Gadjusek's assumptions were simply based on circumstantial evidence. Through a review of the ethnographic literature, it is clear that the cannibalism theory has been unfairly awarded an exceptional recognition based exclusively on two people's judgments, those of S. Lindenbaum's and Dr. Gadjusek's. In his 1976 Nobel Prize speech,

²⁶ Transmission of the kuru agent via cannibalism by the Fore people of Papua New Guinea

Gadjusek stated:

We believe that contamination during the cannibalistic ritual was the sole means of transmission of Kuru from man to man... For Kuru we have a full explanation of the unique epidemiological findings and their change over the last two decades: the contamination of close kinsmen with a mourning family group by the opening of the skull of dead victims in a rite of cannibalism, during which all girls, women, babies-in-arms, and toddlers of Kuru victim's family were thoroughly contaminated with the virus.

(cited in Merbs & Steadman, 1982)

After all, a good science is not subjective and therefore can not be based on opinions, but one which is triggered by objective ideas and completed through physical evidence.

As Arens (1979:97) points out:

it is merely impossible to pick up a book on New Guinea without finding a series of references to cannibalism in the index...Skipping to the actual text results in the now-familiar vague allusions as each author pays his or her mandatory respects to the idea

Margaret Mead has been one of the leading anthropologists to carry out field work in Papua New Guinea during the 1920's and the 1930's. In her book (1950), Mead had devoted a chapter titled "the Pace of Life in a Cannibal Tribe". Even though Mead has made direct reference to the practice of cannibalism, she admits that the ritual was abolished by the Australian missionaries three years prior to her arrival in New Guinea. Thus, as argued by Arens, both the academics as well as the layman can be deluded by making reference to their predecessors who had no solid evidence of this ritual in the first place. This can also be equally applied to the Kuru controversy, where every author in one way or the other has given credence to Shirley Lindenbaum(1979) and

Glasse (1962) for their cannibalism theory. However, Lindenbaum and Glasse were both influenced by their previous colleague Berndt (1952) who was saturated with Eurocentric ideologies.

Despite all the attention that has been placed on the Fore tribe due to the outbreak of Kuru, ironically little attention if any, has been focused on the Fore culture. The entire existing literature has focused on the physical scientific aspects of Kuru, consequently, the cultural aspects of this disease which would inevitably involve extensive research of the Fore culture have been ignored. In order to by pass this barrier the best way possible, I have had to reserve the cultural aspects of my research such as the mortuary rituals, to those tribes other than the Fore, namely the Kukukuku and the Baktaman which share both a physical boundary and a linguistic phyla respectively. By this I attempt to draw parallels between the mortuary rituals of the studied tribes to those of the Fore in order to construct a more objective account of the Fore culture, and specifically their mortuary rituals. Finally, by using epidemiological principals, a linear model²⁷ for the transmission of the Kuru agent will be introduced as an alternative hypothesis to the cannibalism theory.

4.1: Culture of the Eastern Highlands

According to Gadjusek, prior to contact with the Europeans, the culture of the Highlands was neolithic. All groups were and still are excellent agriculturalists,

²⁷ A linear model simply refers to a unidirectional hypothesis with no indirect interference.

cultivating a large variety of edible plants in their gardens with digging sticks. The main diet of all Eastern Highland groups is the sweet potato, sugar cane, taro, yams, banana, and various greens which are grown in the gardens of all tribes. The diet of the Highlands is protein deficient according to the European standards and subject to seasonal variations. For instance, during pig feasts, there is an abundance of meat, whereas there may be no meat supplement for weeks or months thereafter.

In a genetic study carried out by Gadjusek and his colleagues, the linguistic distribution of the Eastern Highlands, which was carefully analysed by Wurm (1964) has been given a special attention. According to Wurm (1964), there are 37 linguistic groups in the Eastern Highlands which differ in size from 150 to 60,000 members. In this classification system, the Fore falls under the Simbari and Barua languages which in turn belong to the Anga (Kukukuku) stock. The Baktaman, also a distant relative of the Anga stock which reside in the central highlands of Papua New Guinea also share similar characteristics with their distant relatives in the Eastern Highlands. The Baktaman diet is also composed of taro, sweet potato, and yams in addition to a large variety of edible greens (Barth, 1975).

4.2. Baktaman:

Baktaman, a central highland tribe of the Papua New Guinea which is comprised of about 200 people is situated to the West of the Fore and Anga (Kukukuku) (Fig 4.1). As mentioned earlier, this tribe is a distant relative of the Fore and is a member of the Eastern Highland linguistic stock. Although geographically

isolated, this tribe makes a suitable candidate to be studied since culturally it shares the same background with the Fore and the Kukukuku.

The Baktaman territory covers over 250 square kilometres of mountain and valley which are exploited for hunting and cultivation of crops. Taro²⁸ is the main food crop along with other fruits. As Barth (1975:30) points out:

...raising of pigs (the most favoured meat and the crucial provision for feasts and blood sacrifices), and to hunting, especially marsupials, wild pig, and cassowaries (which constitute the major source of protein and are used for sacramental meals and offerings to ancestors).

There is a large variety of animal fauna which the Baktaman consume. Such stock as wild pigs, marsupials and rodents [such as rats, flying squirrels, bandicoots, opossums, cuscus, tree kangaroos, marsupial mice, and tiger cats], bats, cassowaries, birds, snakes, lizards, frogs and toads, fish, and a variety of invertebrates. The rich bird fauna of New Guinea provides a large variety of species in the Baktaman territory.

Slash and burn is the prominent method of cultivation among the Baktaman, which inadvertently requires a continuous allocation of land. The secondary crops which constitute the vegetables, sweet potatoes and bananas, are also cultivated next to the staple food: taro. According to Barth who carried out his field work among the Baktaman in 1975, the Baktaman life is organized and planned according to the cultivation of taro.

²⁸ Taro is a large, tropical plant (*Colocasia esculenta*) of the arum family, with shield-shaped leaves.

Mortuary Customs

Mourning in this tribe is a communal matter; in other words, the death of every individual in the group is mourned by the whole village. The entire community must observe the customs of grief for four days whereby gardening and hunting are not permitted during this time. The women smear themselves with mud or ash, also, breast bands with tassels are made and worn by close family members; "Daughters often hang a couple of their mother's taro scrapers (yom) on the tassels so that the musical sound of their striking together will 'remind' them". (Barth, 1975: 124). Women are known to commit suicide for the death of a husband or a child. In addition, the deceased's garden is destroyed and burned, his pigs and dogs are killed and consumed to symbolize the community's anger for his death (Barth, 1975).

Once the corpse is stripped and cleaned, the wrists are tied together and the body is then left in his/her house for the close family members to pay their respects. A few hours later, the body is wrapped in edible fern and carried to a secluded location where it is then placed on a stand and covered by bark. The mourners then disperse and return, each taking a different route, presumably to confuse the dead spirit and in turn preventing it from returning to the village. Barth further elaborates:

After a day or two the closest relative revisits the corpse, speaks comfortingly to the dead and fans away flies and other insects. Thereupon the body is left to decompose for some months, and the area is taboo to all.

(Barth, 1975:125)

Once sufficient time is allowed for the body to decompose, the close family members return to the site to complete the final disposal of the deceased. During this final stage, a fire is built on the ground beneath the platform supporting the corpse where the completing step in the Baktaman funerary ritual is carried out.

One of them climbs up and hand down the skull; it is warmed over the fire and the dead person's spirit is invited to enter it; then it is put in a net bag. Next, the mandible is similarly treated, sometimes also the right-hand radius, ulna, and finger bones, clavicle and breastbone. These and most other larger bones of the skeleton, especially of the right side, are all collected together in the net bag and carried to a limestone cave to be deposited. (Barth, 1975:125)

Baktaman makes an excellent candidate to be studied for the comparative analysis carried out in this thesis. As reviewed above, even though the Baktaman work hard in their gardens in order to cultivate taro and other edible vegetables, as well as hunting down wild pigs and other species of animals, nevertheless, malnutrition²⁹ is not a contentious issue in this society. Also, as observed by Barth during his field work, no cannibalism was noted during the funerary practices of the Bakatamans, however, during the final stage of this ritual, a close physical association with the skull was observed.

4.3. Kukukuku (ANGA):

The Kukukuku are located in the Gulf of Morobe among the Eastern Highland Provinces of Papua New Guinea measuring to about 6000 square miles in area

²⁹ This is argued by a few academics who believe in the lack of sufficient food in the tropical regions and thus, the motive behind cannibalism.

Figure 4.1: Location of Baktaman with respect to the Fore region

(Hallpike, 1978) (Figure 4.2). This tribe belongs to the same Anga (Kukukuku) linguistic stock among which the Fore also belongs. The inhabitants of Kukukuku live in high altitudes which automatically restricts them to certain diets, as pointed out by Hallpike (1978) :

Inhabiting the rugged mountains of the central chain running down the Spine of New Guinea, usually at heights between roughly 3,000-8,00 feet, the Kukukuku are bush fallowing cultivators of sweet potatoes, as well as yams and taro, and with a high level of technological sophistication in salt making, and in the construction of various traps.

The Kukukuku live in isolated groups of two or three huts, and very seldom as many as a dozen or so huts are within sight of each other. The fundamental source of nutrition for these people is supplied through sweet potato in conjunction with taro and yams, although, the soil is not suitable for the cultivation of the latter two (Hallpike, 1978). Meat is not a readily available game for the Kukukuku, however, they make use of a large variety of different species ranging from pigs and dogs to marsupials, rodents and reptiles. As the ethnographer Hallpike (1978), points out during her field work

Tree rats, iguanas, lizards and snakes are all acceptable... A species of white grub collected from rotting tree trunks is a special delicacy, and is either eaten raw or roasted on leaves over the fire.

Although the Kukukuku have to work very hard in order to obtain their food, nevertheless, they are not malnourished. Having examined the basic constituents of the Kukukuku diet, no evidence of 'human flesh' was found. However, as

Figure 4.2. The Anga (Kukukuku) region with respect to the Fore and other Eastern Highland tribes

cannibalism is usually associated with the mortuary ceremonies, the following section will focus on the funerary customs of the Kukukuku.

4.4. Mortuary Rites:

Among the two tribes studied here, the Kukukuku tribe is the immediate neighbour south east of the Fore region (Fig4.1). The similarities in their mourning practices to that of the other neighbouring tribes is quite astonishing. The people of this tribe believe that the spirit of the deceased hovers around the body for a time, ensuring that proper funerary practises are carried out. Similarly, it is believed that during one's sleep, his/her spirit can leave the body and wanders about in the dark. For this reason, a Kukukuku never awakens a sleeping friend too suddenly, for his/her spirit must have enough time to return to the body.

After death, the near relatives are grief stricken over their loss. They cover the body with mud, and throw themselves on the ground beside the corpse, eat soil, tear their hair, and beat themselves with sharp flints until blood pours out of their bodies. Such intense activities are maintained for four to five days/nights. On the fifth day of the mourning, the body is laid on a built stand where it is kept warm by the fire under the stand. This acts as catalyst to aid in the decomposition process. After approximately ten weeks, when the body has been shrunk to half of its original weight due to water loss, the bones are carried to the top of the mountain, away from the village, where they are disposed.

One of the prominent rituals which the people of Kukukuku perform for the dead is the smoking of the corpse. As it was pointed out earlier, the Kukukuku light a fire below the stand on which the corpse is resting, this way the body decomposes more rapidly³⁰. The Nauti³¹ people, also one of the many villages which treat the corpse with fire perform a certain ritual prior to the smoking a body, Hallpike points out that a number of protocols are followed:

Before the Nauti smoke a corpse his relatives take a leaf and rub it over his skin and remove it all, and cut his hair, and remove the skin over his scalp...Then they put him over a fire; when he dries the flesh is hard...The skin is put on a small platform outside the house, and when the man is put up in his platform among the pandanus trees his skin is put below. (Hallpike, 1978:134)

According to one of the informants, Hallpike points out that the reason behind the above mentioned ritual is to prevent the dead from rising from the ground.

When a man dies he goes into the ground. If he is smoked he does not come up again, his skin is too painful. He runs away and goes into the ground. If they did not smoke a dead man he would come up again. (Hallpike, 1978:134)

On a personal encounter Hallpike describes his experience during a Kukukuku funeral.

The deceased was an eighteen year old boy who belonged to the Nauti tribe. As Hallpike recounts this event:

Sound of wailing came down the hill before we reached the house;

³⁰ It is also said that the smoking of the corpse is symbolic of the community's grief: As the corpse disintegrates and becomes unrecognizable so too should the grief.

³¹ One of the villages of the Kukukuku tribe.

as we approached, our party started wailing...The hut was packed with people; I had just room enough to half sit by the door...for some time I could see little in the darkness and smoke, but finally made out the corpse...the women sat on the left of the corpse, the men on the right...the body was so bloated that it was unrecognisable...it was placed in a kind of swing chair made of cane...the bottom about a foot from the floor. Beneath was a layer of ashes, and on these some grass or leaves...in front between the body and the door was a fire, the smoke of which filled the hut...this would go on for about a month till all the 'water' had gone from the body. and then they could put him among the pandanus trees. (Hallpike, 1978:134,135)

A few villages such as the Manki³² however, do not smoke their dead. Instead, the corpse is laid on the platform built on the tree, until the body is decomposed completely. The remaining bones which eventually fall to the ground are left undisturbed. Since contact with the missionaries however, the Manki have discontinued the exposure of the corpse presumably for sanitary purposes. Therefore, it is evident that cannibalism was not practised by some of the closest neighbouring tribes of the Fore, and from this, one can draw parallels to the mortuary customs of the Fore to emphasize the lack of cannibalism in this region.

As mentioned earlier in this paper, transmission of Kuru was linked to the alleged practice of cannibalism among the Fore of Papua New Guinea. However, it is my belief that the Kuru agent was transmitted among the Fore through means other than cannibalism, since direct evidence of this ritual among the Fore does not exist and such accusations were based solely on circumstantial evidence. An alternative hypothesis with regards to the mode of transmission of Kuru can be proposed by

³² This village is located in the centre of the Kukukuku region, north of the Nauti

borrowing some of the basic concepts involved in the field of epidemiology. In the final section of this thesis, the discipline of epidemiology will be introduced and the key concepts relevant to my hypothesis will be discussed.

4.5. Epidemiology

One of the most useful tools in medicine and related disciplines is the use of epidemiological techniques in determining and predicting the risk factors involved with diseases, particularly those that are infectious in nature. The discipline of epidemiology is specifically interested in the patterns of disease occurrence in human populations and the factors that affect such patterns. Consequently, epidemiologists are primarily concerned with three factors: time, place, and persons, all of which are involved in the transmission of a given disease (Lelienfeld, 1994). By various clinical and statistical measurements of these factors, the epidemiologists can determine whether there has been an increase or a decrease in the transmission of a given disease, whether the disease is concentrated in a particular geographical area, and finally if the victims possess certain characteristics which make them more susceptible to that particular illness. According to Hirsch (1990) historical and geographical pathology³³ is "Science which ... will give, firstly, a picture of the occurrence, the distribution and the types of the diseases of mankind, in distinct epochs of time and at various points of the earth's surface; and secondly, will render an account of the relations of these diseases to the external conditions surrounding the individual and determining his

³³This is now referred to as epidemiology

manner of life". Borrowing the framework from his statement, epidemiologists are primarily concerned with the following five characteristics:

- i. Demographic characteristics such as age, gender, race, and ethnic group.
- ii. Biological characteristics such as blood levels of antibodies, chemicals, and enzymes; cellular constituents of the blood; and measurements of physiological function of different organ systems.
- iii. Social and economic factors such as socioeconomic status, educational background, occupation, and nativity.
- iv. Personal habits such as tobacco and drug use, diet, and physical exercise.
- v. Genetic characteristics such as blood groups.

According to Lilienfeld (1994), epidemiology is a science of reasoning, an integrative discipline which obtains its methods from and overlaps with such diverse fields as statistics, public health, geography, biology, and anthropology, in order to investigate a disease in a population. Furthermore, through the integration of these disciplines, the factors which determine the occurrence of a disease in a population can be isolated (Lilienfeld, 1994). In any given epidemiological inquiry, the information obtained can be employed in several ways:

- i. To explain the etiology of a specific illness or group of diseases by integrating the epidemiological data with information from other disciplines such as biochemistry, genetics, and microbiology.
- ii. To evaluate the consistency of epidemiologic data with etiological hypotheses.
- iii. To develop techniques for preventive measures and public health practices.

Two characteristics which set epidemiology apart from medicine and other physical sciences are that I: the field is concerned with diseases as they occur in populations not

individuals; and ii: the distribution of the disease as opposed to the disease itself is studied in order for the cause (s) of the disease to be determined. In the following section some of the key concepts that are closely associated with the field of epidemiology, such as the population and parasitic model will be discussed.

4.6 The Population Approach

In its broadest sense, population can refer to 'species', however, it is frequently used in reference to ethnic groups, local groups, or social strata. In fact, population is the main factor which permits the epidemiological studies to relate the biological and cultural evolutions. The biological evolution is the type which is associated with the parasite-host relationship, and may be involved with either the host's innate susceptibility or resistance to its parasite. The cultural evolution on the other hand deals with social factors specific to a given human- host population and not that of the parasite's (Boyd, 1985). Thus, the population model in epidemiology almost always alludes to both the human host and to populations of disease-causing species, and the way these two factors consolidate and overlap in the form of human epidemics.

4.7. The Parasitic Model

This paradigm helps to conceptualize the 'population' perspective. In contrast to a symbiotic relationship where each organism depends on the other for its existence, the parasitic relationship is a one-way association. While the parasite depends on its host in order to exist, the host on the other hand gains no advantage and is better off in the absence of the parasite. It should be pointed out however, that most parasites are

harmless to humans and only a few can cause diseases³⁴. Such disease-causing 'pathogens' are often short lived and perhaps serve as a temporary step in the process of evolution (Boyd, 1985). In other words, once a certain number of hosts are killed by these pathogens, the host will develop immunity to the parasite's detrimental effects which consequently leads to a more benign host-parasite relationship. Some of the disease-causing pathogens can result in debilitating disorders such as malaria, smallpox, plague, and most forms of influenza.

By examining the above mentioned concepts, it is only logical to predict that the Kuru agent, like any other viral agent, can be very easily transmitted from one host to the other via handling of the infected tissue(s). As for the Fore, handling of the brain during the mortuary practises is sufficient for the Kuru agent to be transmitted to the participants through abrasions of the skin (ie: cuts and wounds), and also through the mucous membranes such as the rubbing of the eyes. In addition, due to the lack of hygienic practices following each ritual, the participants' contaminated hands served as a perfect vehicle for the transmission of the viral agent to their children who were also present during such rituals. Furthermore, this idea is strengthened by the fact that women and children were the sole participants in the mortuary practises and the epidemiological data shows that the majority of the victims who contracted

³⁴By destroying the host, the parasite is also demolishing its environment which may consequently leads to its own destruction .

Kuru were women and children³⁵. In support of this argument I propose the following basic model as an alternative mode of transmission of the Kuru agent among the Fore of Papua New Guinea.

Figure 4.3: Alternative Model For the Transmission of the Kuru Agent During the Mortuary Rituals Among the Fore of Papua New Guinea

It should be emphasized however that the advance of the above model has been partially due to the prion theory which clearly demonstrates the highly infectious nature of spongiform encephalopathies such as Kuru. Although a model similar to the one above had been entertained by Gadjusek, he still believed that the only means of entry of the virus occurred through the ingestion of the infected tissue(s). Once again, my intention is not to dismiss Dr. Gadjusek's cannibalism theory but rather to suggest an alternative way of viewing the Kuru crisis.

As it was pointed out in chapter 2, those laboratories which work very closely with the spongiform encephalopathies such as CJD take extreme precaution not only

³⁵ Supported by the data obtained from Gadjusek's studies during the Kuru endemic, as stated in the introduction

in working with the infected tissues such as the victim's brain, but also in the handling of instruments used during the experiments. Furthermore, the standard laboratory decontamination procedures does not hold for the prion contaminated apparatus.

There are a number of set protocols specific for such contaminations in order to ensure absolute disinfection of these instruments.³⁶ Once again, such strict protocols are the result of a number of reported accidents where either the patients or the physicians were infected with these deadly particles. Table 4.1 lists the reported iatrogenic³⁷ cases of CJD by the year 1992. These data represent both the central and the peripheral inoculation of the CJD agent which further emphasizes the extreme level of infectivity of the prions. Perhaps if the above data were available to Gadjusek and his colleagues thirty years ago, he would have also made the same assumptions as I currently make.

In the early 1980's an anthropologist named Lyle Steadman published a report illustrating the lack of physical evidence for the alleged cannibalism practised among the Fore. Furthermore, Steadman also argued that no one has ever observed a cannibalistic activity among the Fore people and the only piece of evidence that Gadjusek presents stems from the stories that were supposedly told by a few Fore elders.

³⁶ For further detail on these protocols refer to chapter 2.

³⁷ Accidental transmission of an infected particle such as the prion.

Table 4.1: Reported Iatrogenic Cases of CJD
(Adapted from British Medical Bulletin (1993) 49(4):964)

Mode of Infection	Number of Patients	Agent Entry into Brain	Mean Incubation	Clinical Presentation
<i>Instruments:</i> Neurosurgery Stereotactic EEG	4 2	Intra-cerebral	22 months 18 months	Dementia Dementia
<i>Tissue transfer :</i> Corneal transplant Dura matter implant	1 6	Optic nerve Cerebral - surface	18 months 42 months	Dementia Dementia
<i>Tissue extract transfer :</i> Growth hormone Gonadotrophin	21 2	Hemato-genous	12 years 13 years	Cerebellar Cerebellar

Berndt (1952) and other researchers all claimed that the Fore practised cannibalism but failed to make any reference to the source and authenticity of these statements; even though all claims of this practice are based on 'folk tales'. Despite the emphasis placed upon cannibalism, Gadjusek and his team ironically made continuous reference to the possible contraction caused by the abrasion of skin and the mucosal membranes . In a genetics study published by Gadjusek and Alpers (1972), Gadjusek points out: "to discriminate between parts played by genetics and cannibalism in the etiology of kuru, we need reliable data on both factors pertaining to specific individuals: such data, on cannibalism at least, are unfortunately no longer available" (Gadjusek & Alpers, 1972:S2). I cannot help but to wonder whether such data were ever available,

and one wonders why this information would be missing in the first place.

There are a number of ethnographic flaws in the works of the academics who were active researchers during the Kuru outbreak. For instance, Berndt (1952) had pointed out that cannibalism had been suppressed by the Australian missionaries three years prior to his arrival in the region in the early 1950's, while Glasse (1962) claimed that the practice was "abolished" four years before his entry to the Fore. Thus, there is a clear contradiction in the ending period of cannibalism among the Fore. However, as Arens (1979:110) argues, a strong and consistent case is created when a number of assumptions are accumulated:

...First, Glasse (1962) argues that the Fore became cannibals at the turn of the century, which conforms to their statements about the initial appearance of the disease. Second, the Fore idea of the proclivity of only women to eat human flesh would account for the age-sex distribution of the disease, since a mother would be likely to pass on infected tissue of a human victim to young children of both sexes. Third, there has been a gradual decline in Kuru deaths since the height of the disease in 1961, just after the appearance an effective European presence which would have stamped out any remaining vestiges of cannibalism.

Arens further adds that this kind of an association is not a cause-and-effect relationship since the act has never been observed. Also, the ideology of the few Fore male informants who had claimed for the alleged female cannibalism in the past, most probably stems from the sexual antagonism and opposition which the Fore are famous for (Lindenbaum, 1979).

According to Lindenbaum (1979), among the Fore each death is followed by a ritualistic feast involving the "slaughter" of the pigs and the consumption of the meat

and vegetables. Thus, such ritualistic periods with the abundant animal protein would be the least likely times to engage in cannibalism. This contradicts what some scientists would like us to believe. For example, Gadjusek argued that during the 'cannibalistic feasts' the whole body was consumed:

Meat and viscera, including brain tissue, were taken from the corpse and cooked in the usual ways, by wrapping in leaves in a steam oven or stuffing into bamboo cylinders. The whole body was eaten, and the meat considered delicate in flavour; the bones were pounded and eaten with greens...

(Gadjusek & Alpers, 1972:S10)

In order to explain the female to male ratio, Gadjusek further added:

The womenfolk especially were enthusiastic cannibals; the men less so, and then only of the meat...The women would more often have acquired the agent by direct ingestion at a cannibal feast.

(Gadjusek & Alpers, 1972:s10)

It is astonishing as to how one can present such detailed and graphic description of a ritual without ever having observed the act.

As already stated, what seems to be quite blatant in the cannibalism theory is the lack of emphasis placed on the cultural aspects of the disease. Despite the fact that Gadjusek is recognized as an anthropologist by some of his colleagues, and perhaps by those who were involved with the Kuru endemic, the extent to which he was trained specifically in the theories and methodologies of anthropology is questionable.

Although the mortuary practices of the Fore are fundamental to the transmission of Kuru, tremendous ambiguity exists concerning these activities as described by Gadjusek, Steadman and others. The fact that an entire theory concerning

transmission could have been proposed and accepted amongst the scientific community without there being any witness to cannibalistic acts suggests a lack of anthropological focus.

One of the questions often asked with regards to the transmission of Kuru in the Fore region is why the disease became an endemic only in this region and not in the surrounding areas or tribes. Although Gadjusek and his colleagues tried to answer this question by linking cannibalism with the transmission of the virus, through the current knowledge of the prion theory, this enigma can be easily challenged. As mentioned in an earlier chapter, Kuru is one of the prion diseases and therefore, does not require any external aid to infect the victim's body. Presuming that the Fore handled the deceased's skull during the mortuary practices, all that would have been required for the initiation of the disease is the occurrence of a sporadic³⁸ case of Kuru among the Fore. This way, the contamination would have started during the funerary ritual of the diseased who had fallen victim to this sporadic case.

4.8. Hygiene:

One of the key factors involving the transmission of the Kuru virus involves the communal hygiene. The common denominator in all of the mortuary practices discussed so far consists of handling the decomposed body parts, specifically the skull. As Steadman also argues, this alone is sufficient to transmit the "virus" from the corpse to those handling it. Furthermore, it is likely that such western medical concepts

³⁸ Occurring in single

as “virus”³⁹ and “disease” would not be etiologies consistent with the Fore world view. Also, as illustrated earlier in this chapter, the proposed linear model for the transmission of the virus is emphasized through the mortuary rituals practised by the Fore women. Due to what western biomedicine would consider “lack of personal hygiene”, after each mourning ritual, women will eventually feed their children, thus, if the corpse is infected with the virus, the children will inevitably contract the disease via their mothers. Due to the influence of the missionaries following the Kuru endemic, the residents of the Fore region have undoubtedly to some extent adapted to the western hygienic practices, and this has most likely altered their mourning practices. This would in turn explain the sharp decline in the transmission of Kuru and thus the end to the endemic of this deadly disease.

The purpose of this chapter has been two fold: i- to identify the theoretical and methodological flaws in Gadjusek’s research and ii- to propose an alternative solution in order to improve the existing theory with regards to the transmission of the Kuru agent among the Fore of Papua New Guinea. By illustrating the lack of evidence in the existing literature for the practice of cannibalism among the Fore, and through a comparative analysis of the mortuary rituals of two of the Fore’s culturally related tribes, the first goal of this thesis has been achieved. Secondly, with the aid of

³⁹ Refer to chapter 2.

epidemiological concepts a linear model for the transmission of Kuru is constructed which is further emphasized by the prion theory⁴⁰.

Chapter 5: Conclusions and Future Implications

The ideology of man-eating provides a pregnant cluster of imagery and metaphor to express the exercise and experience of power, domination, and subjection which may be realized in different forms in particular historical and cultural contexts. The appellation 'cannibal' is not merely an appropriate term of contempt for uncouth subjects at the bottom of the political hierarchy or on the edge of civilized world. It may be applied equally appropriately by the victims of oppression to designate their superiors. The designation 'cannibal' can thus convey a sense of impotence and desperation and is consequently not always flattering to its user.

(Lewis, 1996:69)

There are several methodological implications that arise from this research. As discussed throughout this thesis, there have been methodological flaws and thus questionable conclusions made by Gadjusek and his colleagues in the spread and transmission of the Kuru agent. Consequently, the popularity of the cannibalism theory has been embraced and accepted by the entire world of academia. It is difficult to fathom how credence can be given to such statements without the presence of any physical evidence. Perhaps its persistence has been due to ethnocentric attitudes by medical 'anthropologists' lacking cultural anthropological training. The notions 'primitive' and 'barbaric' are often associated with the tribes of Papua New Guinea wherein cannibalism would certainly fit the stereotype. Also, the mistreatment of cannibalism by anthropologists and other scientists has led to the negative connotations surrounding this ritual. As pointed out in chapter 3, very few anthropologists have recognized and given acknowledgement to the cultural

significance embedded in ritualistic cannibalism.

As Beth Conklin illustrated, endocannibalism has by no means any affiliation with the lack of proper nutrition among a given group as some scientists would argue, on the contrary, it is a symbolic rite which reflects a society's belief system in which the spirit of the dead is rejuvenated in the physical bodies of close kinsmen.

Furthermore, this ceremony has a much more profound function which unifies the members of the involved clan. Unfortunately, due to the persistence of deep-seeded ethnocentric attitudes, such vital functions involved with endocannibalism and other unaccustomed rituals are neglected. Anthropologists have historically been intrigued by the 'exotic other' and a ritual practice such as cannibalism would attract interest and worldwide recognition. These factors may have motivated the lack of attention paid to such methodologies as participant observation, interviewing, emic perspectives, and those research strategies that would elicit valid data on mortuary practices, rather than conclusions based on 'heresay'.

Although Gadjusek did make reference to the possible transmission of Kuru via routes similar to those proposed in this thesis⁴¹, he believed in the involvement of a more complex mechanism which led to the Kuru endemic. Once again, Gadjusek was in a disadvantaged situation since he had no knowledge of the prions⁴² or the 'prion theory' which inevitably becomes crucial in one's evaluation of Kuru with

⁴¹ Linear model of Kuru transmission illustrated in chapter 4.

⁴² Refer to chapter 2 for more detail

regards to the transmission of the agent. It is only through this lens that the magnitude of the prions' infectious nature becomes evident, and this in fact helps us to understand how this disease became an endemic in such a short time frame. The following diagram is a schematic representation of how Kuru became amplified among the Fore.

Figure 5.1: Schematic Representation of the Amplification of the Kuru Spread During the Fore Funerals. (A1 represents the funeral of the first Kuru victim; b1, b2: the funeral of the participants who contracted the disease during the A1 funeral and ETC...)

*** Note: This diagram assumes a 20% contraction rate.**

As can be seen in the above diagram, the rate at which the disease was spread is quite astonishing. Thus, if only ten participants were present during each funerary ritual, and only two of the ten contracted the disease, and keeping in mind that the disease took about twelve months to kill its victims⁴³, in a period of ten years 1,023 people would contract and die of Kuru. Through this example, the horrifying effect of this disease on the Fore tribe can be appreciated.

⁴³ The medical studies carried out by Gadjusek and his team during their field work shows an average of 12 months for Kuru to have killed its victims.

In the final section of this thesis I elaborated on Steadman's anticannibalism hypothesis and proposed a new linear model for the transmission and spread of the Kuru agent. This model was further emphasized by the 'prion theory' which has been proposed by Pruisner for almost a decade. Pruisner's theory gives support to the suggested linear model by illustrating the 'prions' infective nature, a fact which was missing during Gadjusek's era.

While Arens' contention that the existence of cannibalism is questionable in all societies may be a drastic conclusion, it does appear that the presence of cannibalism in Papua New Guinea has been exaggerated, embellished, and even mythologized. Through a careful scrutiny of the ethnographic data concerning the Fore and its neighbouring tribes, no first hand account of cannibalism has been recorded. Through the work of Conklin, it is apparent that even among those societies where cannibalism is present, the evaluation of its significance has been distorted by anthropologists. With the new evidence concerning prions, another possible and more likely means of Kuru transmission has been proposed. Western researchers are often all too anxious to label the people and cultures they study into neat organised categories irrespective of the evidence. Perhaps cannibalism among the Fore is a case in point.

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