

## Flying bats in Guam - the cause of the complex

*In this issue we are pleased to publish an interview with Drs Oliver Sacks and Paul Cox, following their recent research which suggested that eating flying foxes was responsible for an isolated cluster of ALS-parkinsonian-dementia complex found in the Guam peninsula.*

*As an interesting counterpoint to this article, we are also publishing a commentary by Dr Huw Morris. Dr Morris, who spent some time in Guam, is able to rely on his own experiences and local knowledge and contacts to provide a cautionary note.*

### 1. What are characteristic clinical features of ALS-Parkinson dementia complex?

There can be separate presentations of a motor neurone disorder (with wasting and spasticity, ultimately death from bulbar palsy), parkinsonism (usually with marked rigidity and akinesia, less tremor, than in ordinary PD), and a dementia (often presenting as an amnesic syndrome) – or these can co-exist in a single individual. ALS-like presentations were much commoner in the earlier days, whereas parkinsonism-dementia ones predominate now - **OS**

### 2. What has happened to the disease since the second world war?

The disease has become much rarer, altered its presentation (as noted above) and its age of onset: back



A flying fox eating the fruits of a cycad in Guam. One of the main food sources of the flying fox are the fruits of the native cycad trees which contain potent neurotoxins, chemicals that can damage nerve cells.

Photo Credit: Dr. Merlin Tuttle, Bat Conservation International



A flying fox is prepared for consumption at a Chamorro feast. The Chamorro, who are the native peoples of the Pacific island of Guam, boil the animal in coconut milk and consume it in its entirety. Research published in the March issue of Neurology conducted by a National Tropical Botanical Garden investigator suggests a possible link between plant toxins ingested through consumption of flying foxes and a high incidence of central nervous system disease in Guam.

Photo Credit: Dr. Merlin Tuttle, Bat Conservation International

in the early 1950s there were people in their twenties affected, now they are mostly late middle-aged or elderly people. No-one (or very few people) born after 1960 seems to have contracted the disease – though there may be, apparently, an ‘incubation period’ of decades between the initial ‘event’ (infectious, toxic, whatever) and the appearance of the complex - **OS**

### 3. How common is the condition in people migrating to and from Guam?

The 100,000-odd Chamorros in California (many of whom left Guam forty years ago) have the same incidence of diseases as those in Guam. The disease is almost or virtually unknown except in the native Chamorro population of Guam (and the native populations of the Kii peninsula and two villages in Irian Jaya, where a similar disease occurs). Migrants to Guam do not, apparently, get affected - **OS**

ALS-PDC is a disease primarily of the Chamorro people, but did not characterise non-Chamorro residents on Guam unless they adopted a traditional Chamorro lifestyle - **PC**

### 4. What is the evidence for a genetic as opposed to an environmental cause for this condition?

The evidence against a genetic causation is the absence of clear ‘Mendelian’ patterns of inheritance. The epidemiological evidence (or hint) of environmental determinants comes from the confinement of the disease to Guam (and two other places), and its much higher incidence, in Guam, in certain villages. Again it is known

that cycads are full of neurotoxins – neurocyadism has long been recognised among cattle in Australia who browse on the *Macrozamia* there – and careful washing etc is required. But there could also have been an infectious cause of lyticobodig (ALS-PD), an inapparent infection (as often happened with those who subsequently developed postencephalitic parkinsonism and other postencephalitic parkinsonism syndromes - OS

#### 5. Why flying foxes as causative animal?

Because flying foxes native to Guam feed on the native cycads there, and may bioconcentrate some of their (lipophilic) toxins.

Support for an environmental cause is suggested by the coincidence between the decline of lyticobodig after 1960 with the decline in eating of cycad flour (long-noted) and the virtual extinction of the native cycad-eating bat around the same time (which we are now noting) - OS

The Chamorro diet and indeed the Chamorro cultural character were uniquely characterised during the twentieth century by mass consumption of flying foxes which led to the extinction of one flying fox species on Guam and the near-extinction of the other species. This in turn led to the importation of other flying fox species from other island nations where cycads do not play a prominent role in the vegetation. As a result of the change in sources of flying foxes, the putative ingestion of biomagnified cycad neurotoxins began to decrease in the 1960s and reached negligible levels in the 1970s when the entire genus *Pteropus* in Guam teetered on the edge of extirpation. The rise and fall of consumption of Guam flying foxes was shadowed by a rise and fall of the incidence of ALS-PDC in Guam - PC

#### 6. Do other communities eat flying foxes and if so do they have a similar condition?

In parts of Polynesia, flying foxes were eaten, but never with the same relish or in their entirety as they are in Guam. And, in those islands of Polynesia where they are eaten, cycads do not play an important role in the vegetation. These islanders do not show higher levels of ALS-PDC - PC

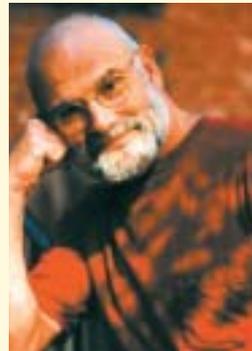
#### 7. Is there evidence for a similar aetiology in the recently described PD-like illness endemic in Guadeloupe?

At present different phytotoxins are under suspicion in Guadeloupe, namely those present in soursops and other *Annoneaceae* – very potent infusions of these are widely used in folk medicine there. There has been no suggestion of an animal vector - OS

#### 8. How can the theory be proven?

- By chemical analysis of carcasses of (preserved) Guamanian bats.
- By seeing if they have any neurological lesions similar to those of ALS-PD.
- By feeding other bats on cycads and seeing if they in fact accumulate and concentrate on the toxins - OS

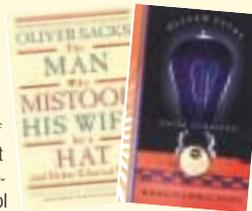
### Authors



**Dr. Oliver Sacks** is concerned with the link between body and mind, and the ways the whole person adapts to different neurological conditions.

He was born in London and obtained his medical degree at Oxford. In the early 1960s he moved to the United States, where he completed an internship at UCSF and a residency in neurology at UCLA.

Since 1965 he has lived in New York, where he is clinical professor of neurology at the Albert Einstein College of Medicine, adjunct professor of neurology at the NYU School of Medicine and consultant neurologist to the Little Sisters of the Poor and at Beth



Abraham Hospital.

In 1966 Dr Sacks was a consulting neurologist for Beth Abraham, where he encountered an extraordinary group of patients, many of whom had spent decades in strange, frozen states, like human statues, unable to initiate movement. These patients were survivors of the great epidemic of sleepy sickness that had swept the world from 1916 – 1927. They became the subjects of his book, *Awakenings* (1973), which later inspired a play by Harold Pinter, "A Kind of Alaska" and the Oscar-nominated Hollywood movie, "Awakenings," starring Robert De Niro and Robin Williams. Dr. Sacks is perhaps best known for his best-selling 1985 collection of case histories from the far borderlands of neurological experience, *The Man Who Mistook His Wife for a Hat*. In 1989, he received a Guggenheim Fellowship for his work on what he

calls the "neuroan-  
thropology" of Tourette's syndrome, a condition marked by involuntary tics and utterances.

His seven books have received numerous awards and been translated into 22 languages.



**Dr. Paul Alan Cox** is Director of the Congressionally chartered National Tropical Botanical Garden in Hawaii and Florida. He also serves as the King Carl XVI Gustaf Professor of Environmental Science at the Swedish Biodiversity Center.

TIME magazine in 1997 honoured

him as one of 11 "Heroes of Medicine" for his ongoing search for new medicines from plants. For his efforts in saving tropical rainforests, in 1997 he shared the \$75,000 Goldman Prize, known as the "Nobel Prize" of the environment. A former Brigham Young University Dean, Cox was named in 1998 by CHOICE magazine as one of the top university leaders in America.

Cox received his Ph.D. in Biology from Harvard University, his master's degree in ecology from the University of Wales, and his bachelor's degree in botany and philosophy from Brigham Young University. He has authored three books and over 120 scientific papers. Married to the former Barbara Wilson, he lives with his family on the island of Kauai.