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## Original Article

## Michel Jouvét and "exotic" sleep

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## ABSTRACT

Michel Jouvét directed my medical thesis on paradoxical sleep in cats obtained in 1969, and my research on sleep in extreme environments (Antarctica, Arctic winter cold, physical exercise), which was the subject of my Ph.D. dissertation in 1984. As a military MD and scientist, I was posted in "exotic" (far away) places (Antarctica, Canada, Niger) and participated in several remote field trials (Canada, Côte d'Ivoire, Congo, Angola). Michel Jouvét supervised my research activity, allowing me the use of his laboratory facilities. He co-authored the work on sleep in Antarctica in 1987. In 1988, he was invited to Niamey (Niger) to preside on the international jury of medical doctorate dissertations. He then examined one of my patients with narcolepsy-like sleep attacks, suspect of sleeping sickness. Jouvét also co-authored our work on nitric oxide in the rat model of sleeping sickness. His scientific curiosity led him to study REM sleep eye movements in Bassari people, an isolated ethnic group in Senegal. With Monique Gessain, he co-authored a book on the Bassari oneiric activity. He was convinced that research in electricity-free villages was capital for understanding past mankind story. The present contribution recognizes the tremendous work capacity and scientific curiosity of Michel Jouvét.

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## 1. Introduction

I began my medical studies at the University of Dakar (Senegal) in 1962. I was fond of physiology, thanks to the comprehensive teaching by Pr. André Maser. One year later, I was a successful candidate to enter the French Military Medical School of Lyon. In Lyon, Claude Bernard's city, my interest in physiology intensified. In September 1965, I met with Michel Jouvét at the Experimental Medicine Laboratory of the Rockefeller-Grange Blanche Faculty of Medicine. He welcomed me and assigned me to work with Bernard Roussel, who was preparing his medical doctorate on paradoxical sleep and noradrenergic locus caeruleus brainstem nuclei in the cat [1]. Jouvét advised me to immerse in science and learn by companionship with other scientists. A few weeks later, I asked him whether he could recommend books on sleep. He replied that the knowledge on sleep was being written "here". I presented my dissertation in October 1969 [2]. Being in the French Forces Medical Service, I spent a year between the Val-de-Grâce school in Paris specializing in military medicine, and the Tropical Medicine Institute "Le Pharo" in Marseille.

At that time, French military MDs were often posted overseas. As I wanted to pursue my carrier in the field of sleep research, I chose to go to Adélie Land in Antarctica. I presented my sleep study project to Michel Jouvét and he approved it, as did Jean Rivolier, MD Chief of Paul-Emile Victor's French Polar Expeditions. However, it was not easy to find a polygraph to record sleep. I finally obtained the loan of an 8-channel EEG recorder from Pr. Henri Félix, one of my former teachers at the military hospital in Lyon. He was then working at the Roche laboratory headquarters in Paris. When I came back from Antarctica in 1972, Michel Jouvét offered me the use of his laboratory facilities to analyze my recordings.

Having met Robert and Monique Gessain from the Musée de l'Homme at Paris, Jouvét had his first contact with Africa. With Monique Gessain, he studied dream recalls in Bassari villagers, an isolated ethnic group living in south-east Senegal. Later, he became committed to judging and/or directing my research in the very hot Sahelian climate of Niger, as I was posted in Niamey.

I opted to focus on the rather unknown eccentric implications of Michel Jouvét outside of the Lyon laboratory in such areas as Antarctica and Africa. I chose the term "exotic" (far away, unusual) in the same sense that led the Noble Price Alphonse Laveran to create in 1908 his prestigious "Société de pathologie exotique" that promotes science in faraway environments, especially on tropical medicine.

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In this paper, I shall present this aspect in the light of investigations performed by Michel Jouvét himself in Senegal, and of field investigations managed by myself in Antarctica, in the Arctic, and the stress of operational exercise which together were the subject of my Ph.D. dissertation with Michel Jouvét as my director. I shall also address investigations on the rat model of African sleeping sickness carried out in Jouvét's laboratory. He was also involved with our work conducted in Niger, and in judging the dissertations of three of my students.

## 2. Michel Jouvét and the Bassaris: first contact with Africa

Michel Jouvét, as an “inventor” of paradoxical sleep, was involved in the study of rapid eye movements (REMs) during REM sleep. His research on different mice strains had shown that the pattern of REM might be under genetic influences. He confirmed that hereditary factors may also be involved in humans, as homozygote twins showed similar REM patterns. After having met with the renowned anthropologists Robert and Monique Gessain, who studied the life style and civilization of the Bassari people in Senegal, he launched an investigation of REM patterns in this isolated ethnic group. At the end of 1974, the field investigation took place at Etyolo, a village near the border of Guinea [3]. After long palavers with the chiefs and women of the village, an agreement was reached and eye movements were recorded in village huts during twenty periods of sleep in five adult volunteers. Although more restless, their sleep patterns were similar to those of European subjects in Lyon. Jouvét and his collaborators were surprised by the scarcity of eye movements in this bush environment deprived of electrical power. Two of their subjects were also recorded in Lyon in March 1975. Similar data were obtained. Unfortunately, Michel Jouvét was unsuccessful in publishing his findings that were regarded unfavorably by the publishers, who were disdainful of the concept that differences may exist between human groups. Jouvét acquiesced, thus depriving the scientific world of capital findings. Monique Gessain and Michel Jouvét were also interested in dream recall. They collected approximately 500 dream recalls from one of their volunteers [3].

Concerning restlessness during sleep, we recently published a study of sleep in remote villages deprived of electrical power in Côte d'Ivoire (Jouvét referred to it as “pre-Edison” sleep) and compared it to urban populations [4]. We found that the more restless sleep of villagers was related to the perceived insecurity of the sleeper, rather than to the physical characteristics of the environment. I cannot help recalling the Middle Age watches that patrolled dark town streets and yelled to the bourgeois “feel safe and sleep well”.

## 3. Field investigations directed by Michel Jouvét

### 3.1. Sleep in Antarctica

I served as the MD of the 21st Expedition to the Dumont d'Urville Station on the Antarctic coast of Adélie Land, close to the Antarctic Circle. Equipped with an ALVAR Minihuit on loan from the Roche Laboratory, I obtained 156 night recordings of sleep in eight of my comrades from April to December of 1971 [5]. The EEG machine was equipped with a double cable in order to record simultaneously two subjects sleeping in their own rooms (air temperature,  $T_a = 20\text{ }^\circ\text{C}$ ). The polygraph was situated in the building corridor under my supervision. The first recording session lasted three consecutive nights. Following recording sessions were performed at one-month intervals for two consecutive nights. A total of 17–21 night recordings was obtained for each volunteer. We did not find any modifications in REM sleep. On the average,

slow-wave sleep (SWS, stages 3 and 4 of non-REM sleep) increased between April and July at the expense of stage 2, and leveled-off afterwards (Fig. 1) [6]. This was attributed to exercising daily on the sea ice to visit our neighbors, the Emperor penguins and Weddell seals.

### 3.2. Sleep in the Arctic during winter

While a NATO Exchange Officer at the Defence and Civil Institute of Environmental Medicine in Toronto, Canada, I had the opportunity to perform two sleep studies during the winter (in February) on the shores of Hudson Bay at Fort Churchill (Manitoba). These investigations were the first polysomnographic studies achieved in human subjects throughout the night in the cold in unheated environments.

In a preliminary field trial, two volunteers from the British Royal Commandoes slept for 10 nights in 9-clo sleeping bags lying down on inflatable mattresses in unheated tents at ambient temperatures between  $-25$  and  $-30\text{ }^\circ\text{C}$  [7]. Even though the subjects had been trained in operations in the cold, they experienced sleep fragmentation with numerous awakenings mainly in the second half of night. Slow-wave sleep and REM sleep were specifically affected. REM sleep occurred in a narcoleptic-like fashion, that is after a long awakening episode without any non-REM sleep transition. When returning to indoor baseline conditions, a REM sleep rebound occurred. Electromyographic (EMG) activity, especially shivering, was absent during REM sleep episodes, although it was very prominent in wake episodes preceding and following REM sleep (see Fig. 2B as an example). Skin temperatures were maintained in the range of thermoneutrality ( $32\text{--}34\text{ }^\circ\text{C}$ ). The occurrence of shivering in such a condition led us to hypothesize that central thermoreceptors were implicated. A complementary investigation was launched in the Toronto cold climatic facility. Eighteen volunteers were exposed to  $-35\text{ }^\circ\text{C}$  during two hours lying in 9-clo sleeping bags. The data showed that thermoneutral skin temperatures are maintained in man while lying in well insulated sleeping bags, but that shivering will occur when only the face is exposed to cold. It was postulated that under such conditions, a countercurrent heat exchange between the jugular veins and carotid arteries may cool and activate the brain thermoreceptors and provoke shivering [8].

The second field investigation involved 8 volunteers from one Canadian and one French regiment [9]. Five night baseline recordings were performed in a temperature controlled facility at the

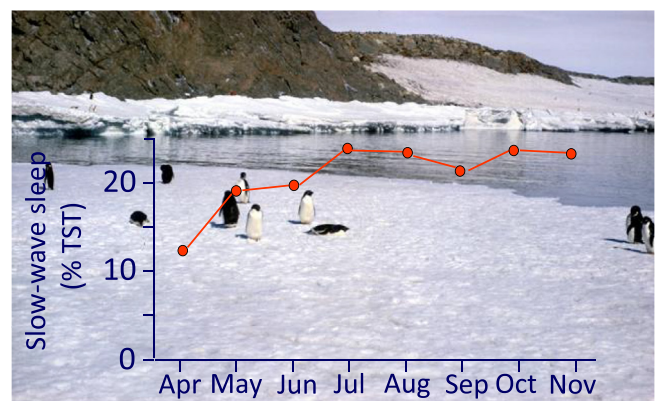


Fig. 1. Time course of slow-wave sleep (in % of total sleep time, TST) in eight volunteers throughout wintering at Dumont d'Urville Station in Adélie Land. The progressive increase in slow-wave sleep was attributed to the exercise due to walking on the sea ice that is possible from May to December.

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