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# A Preliminary Study on the Effect of the Cold on Body Temperature and Heart Rate of Bat (*Vespertilio superans*)

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## 안주애기박쥐(*Vespertilio superans*)에 있어 體溫 및 心臟率에 미치는 寒冷의 影響에 관한 豫報

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**摘　　要**

本 硏究는 안주애기박쥐에 대한 寒冷(6±2°C)의 反應을 調査한 基礎資料로서 寒冷에서 冬眠에 突入時 體溫과 心臟率의 變動樣相은 큰갈색박쥐와 작은 갈색박쥐의 경우와 相異하였다. 體溫曲線에서 흔히 高平部를 볼 수 있었으나, 體溫調節의 特徵인 据齒狀變化는 本 硏究에서는 볼 수 없었다.

## INTRODUCTION

Bats are very interesting animals for use as experimental models on the studies of thermoregulation (Leen and Novick, 1969). The present study was conducted to find the physiological responses in terms of body temperature and heart rate when bats are subjected to cold treatment which is known as one of the factors leading them into hibernation.

## MATERIALS AND METHODS

Five female bats (*Vespertilio superans* Thomas) captured in Euchungboo, Kyunggi-Do, on September 18, 1974 were used in the present study.

For finding the response of body temperature and heart rate when they are subjected to the cold ambient temperature (6±2°C), the following procedures were performed. Surgery was performed to implant a small thermocouple so that the body temperature could be measured. The tip of the thermocouple was always beneath the skin of the back between two scapulae. Two small electrodes were attached to the wings to record the heart rate (beats/min). After surgery the animal was left in the resting state (37°C) for two hours in order to stabilize it.

Right after entering the cold room the thermocouple and the electrodes were connected to a polygraph (Grass Model 5) for recording. Each recording was made at five minutes intervals.

## RESULTS AND DISCUSSION

Fig. 1 shows the responses of bats when they are placed in the cold room. The bat #1 decreased its body temperature and heart rate right after entering the cold room. The body temperature fell very rapidly without a saw-toothed pattern of thermoregulation. The animal entered hibernation within two hours. The heart rate was also dropped approximately an hour earlier than body temperature did. After an hour and 45 minutes the body temperature was stabilized at a level of 6~7°C which is thought to be a unique physiological phenomenon in bats that hibernate. The heart rate was also steadily maintained at the low level during hibernation. It is noticeable that there was two short but distinct plateaus in the temperature graph at the point of 45 and 60 minutes.

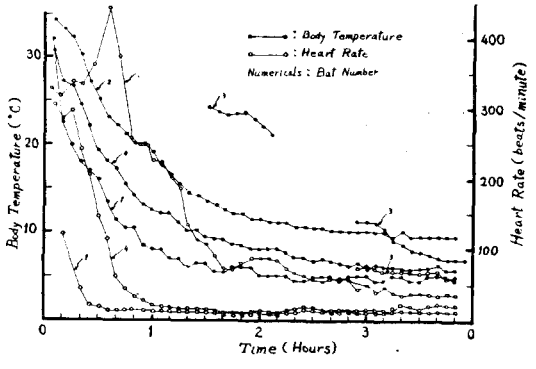


**Fig. 1.** Effects of the cold on body temperature and heart rate of bats.

The bat #2 showed a less sharp drop as time goes by although the body temperature was stabilized within two hours, similar to the former result. It is interesting to see that the starting time of plateau formation and hibernation was similar although the stabilized level of body temperature was different between the #1 and #2 bats. The body temperature of the #2 bat during hibernation was about 10°C.

The bat #3 showed a similar trend observed in the preceding experiment although all the processes of the entery into hibernation could not be recorded because of instrumental trouble. There was a relatively long plateau which began at 105 minutes. Therefore, at three hours and 45 minutes body temperature fell to the hibernation level. The heart rate was already stabilized at three hours.

The bat #4 showed a general pattern of graph that is characterized by a sharp drop of body temperature, a few plateaus in the entery into hibernation and an occurrence of stabilization within two hours in both the body temperature and the heart rate. The heart rate also fell an hour earlier than body temperature did. The heart rate was depressed to an extremely low level, 15 to 17 beats/minute.

The overall results on the effect of the cold on body temperature showed that it fell very rapidly without showing the saw-toothed pattern of thermoregulation which was reported by Koski (1968) and Oh and Koski (1975). It was notable that the

body temperature tended to fall faster in this species than in others, i.e., *Myotis sodalis* and *Eptesicus fuscus* (Koski and Gerhardt, 1974; Oh and Koski, 1975). These plateaus were frequently formed as the body temperature fell down to that of the hibernation level, generally when the time reached an hour more or less. It is likely that the entery into hibernation is interrupted by many small plateaus during which the body temperature falls.

Although the mechanism is unknown, there must be a struggle between the bat and the given ambient temperature. It seems that the length of time spent in thermoregulation before entery into hibernation varies from species to species, and even from bat to bat as shown in the present study.

The heart rate showed similar patterns those found in the temperature graphs. The heart rate fell very rapidly with some interruptions and it was generally much earlier stabilized than the body temperature to the hibernation level. It is notable to see that the bats are able to drop their heart rate to an extremely low level which is about one tenth or less than that of the resting state, which is thought to be around 300~400 beats/minut.

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