ality and more extensive EEG analyses will be necessary to further evaluate cerebral asymmetries associated with emotion.

12. Jones, G. E., & Hollandsworth, J. G., Jr. (University of Southern Mississippi) **Heart rate discrimination before and after exercise induced cardiac augmentation.** Although there is little direct evidence available, there is a pervasive assumption that HR is easily detected during periods of physical stress or exertion. It has also been suggested that distance runners are keenly aware of their cardiac functioning which in turn is a major element of performance during competition. The present study assessed cardiac awareness while at rest and again following vigorous exercise for groups of subjects differing in physical fitness.

Thirty-six subjects were solicited and composed three equal groups: Sedentary, Tennis, and Distance Runners. Groups were chosen to represent three distinct subgroups differing in the aerobic value of their exercise programs. Each group was composed of equal numbers of male and female subjects. HR awareness was assessed using 35 10-sec discrimination trials. Veridical feedback was composed of light flashes triggered by EKG R-spikes whereas false feedback was composed of flashes at rates 10, 20, or 30 percent above or below their actual rate. At the end of each trial, subjects indicated the degree of certainty of their choice. Discrimination accuracy was measured at rest and again following exercise which raised HR level by 75 percent.

Analysis of variance indicated that male runners were significantly more accurate discriminators at rest than any other group. Similar superiority was not shown by the female runners. After exercise, the tennis and sedentary groups showed significant overall increases in awareness during augmented cardiac functioning. Exercise did not produce additional increments in awareness for the male runners. Additional findings and implications will be discussed.

13. Buchholz, R. A., Hatton, D. C., & Fitzgerald, R. D. (University of Oregon Health Science Center) **Autonomic control of the heart rate orienting response in spontaneously hypertensive rats.** The heart rate (HR) orienting response in restrained normotensive rats has been found to be decelerative in direction and due primarily to increased vagal activity (Fitzgerald et al., 1973). Hatton et al. (1979) have recently found that tightly restrained spontaneously hypertensive rats (SHR) also show decelerative HR orienting responses, although of a much larger magnitude. The present study examined the relative contributions of the sympathetic and parasympathetic nervous systems to the enhanced HR orienting response of restrained SHR.

The study utilized 21 male and female SHR, 7-9 weeks of age, assigned to three groups of 7 rats each. All SHR were restrained in plexiglass holders and received 10 presentations of a 10-sec tone (CS). Autonomic control of the orienting response was evaluated by testing one group after sympathetic blockade with propranolol and a second group after parasympathetic blockade with methyl atropine. A third group was given saline before testing. HR was recorded 10 sec prior to CS onset and in 6 2-sec blocks during and following CS presentation.

No significant differences were found in baseline HR between groups prior to drug administration. Subsequent to autonomic blockade, baseline HR in the propranolol group ($\bar{X}$=382 bpm) was significantly lower than both the saline ($\bar{X}$=464 bpm) and atropine ($\bar{X}$=498 bpm) groups, while HR in the atropine group was significantly higher than that of the saline group. The saline group showed large magnitude HR decelerations during the first 2 CS presentations. The largest deceleration occurred at CS onset (33 bpm), returning gradually toward baseline during the later portions of the CS, remaining, however, 18 bpm below baseline at the end of the CS. A further decrease in HR of 4 bpm occurred following CS offset. The HR response to the CS gradually diminished over trials. Both atropine and propranolol effectively reduced but did not eliminate the HR orienting response. Only small nonsignificant decelerations were observed in these groups at CS onset during the first 2 trials. Small accelerations and decelerations occurred unsystematically throughout the remaining trials.

The fact that both atropine and propranolol substantially reduced the HR orienting response in restrained SHR suggests that the large magnitude decelerations were due to a combined effect of sympathetic inhibition and vagal activation. The present findings together with the observation of heightened cardiac sympathetic drive in SHR suggest that sympathetic inhibition may be responsible for the enhanced nature of the cardiac orienting response of SHR.

14a. Roberts, L. E., Williams, R. J., Farrell, V. T., & Marlin, R. G. (McMaster University, Hamilton, Ontario) **Visceral learning as concept identification.** Visceral learning may be depicted as a process in which subjects seek information about the behavioral goal. Concepts of this goal are based initially upon procedural details of training and are modified as feedback identifies instances of the target response. This approach was assessed by determining whether subjects were capable of describing activities associated with the visceral target after feedback training.

Two groups were given visual feedback for changes in heart rate (HR) or lateralized skin conductance (LSC). The two visceral targets within each group (HR: inc/dec; LSC: L>R/R>L) were designated as Response *A* and Response *B*. Production of the response on *A* and *B* trials in the presence (Training) and absence (Transfer) of feedback was measured. After a one-hour session subjects were asked, without prior notification, to provide written reports describing what they did to control feedback on *A* and *B* trials. Awareness of the response was assessed by determining whether judges given the reports successfully identified the visceral target which was required on *A* and *B* trials for each subject. Awareness of activities related to feedback was also assessed by quantitative scales completed by the subjects after the written report.

Awareness of the response was demonstrated on identification tasks for each experimental condition (HR and LSC). Furthermore, awareness (measured as probability of correct identification) was significantly correlated with

performance during Training and Transfer in the HR group, but this relationship was obtained only for Transfer in the LSC condition. Transfer without awareness was not observed in either group.

Scale ratings did not differ between the visceral targets in either training condition. However, awareness was confirmed by significant correlations between these ratings and visceral performance for Training and Transfer in the HR group and for Transfer in the LSC group.

These findings suggest that veridical concepts of the behavioral goal are formed during visceral learning. The concept-formation process appears important to Transfer but does not fully explain performance on feedback trials in the LSC experiment.

(Supported by A0132 from NSERC of Canada)

14b. Keleher, B., & Roberts, L. E. (McMaster University, Hamilton, Ontario) **Effect of feedback training and knowledge of results on discrimination of skin conductance responses.** Visceral learning has been depicted as a concept-formation process in which feedback identifies discriminable activities related to the behavioral goal. Production of the response in the absence of feedback is possible when a reportable concept of the goal has been formed. The present experiment tested for such concepts by examining choice behavior on a response-state discrimination task.

Two groups received 2 days of discrimination testing after 1 day of feedback training (FBT) to control skin conductance (SC). One group received knowledge of results (KR) for correct choices on discrimination trials (Group FBT-KR) whereas the other did not (Group FBT-$\overline{\text{KR}}$). A third group received 3 days of discrimination testing with KR, but FBT was omitted (Group $\overline{\text{FBT}}$-KR). Trial sequence was established prior to discrimination testing to ensure that ordering of trials was not influenced by visceral performance or the subject's choice behavior.

Only groups given prior training to control SC successfully distinguished between the presence and absence of phasic SC responses on the discrimination test. KR facilitated discrimination but was not necessary for success on this task. Subsequent analyses attempted to determine whether: 1) trial probability, 2) trial sequence, 3) choice sequence, and 4) intertrial interval influenced choice behavior. Although evidence for an effect of trial probability was found, the discrimination performance of Group FBT-$\overline{\text{KR}}$ and Group $\overline{\text{FBT}}$-KR indicated that this variable was not sufficient for success on the discrimination task.

While successful discrimination indicated that a concept of the goal had been formed, the correlation between discrimination and control of the response was not significantly different from zero within either of the two groups who received FBT. This is in contrast with previous experimentation which found a substantial correlation between visceral performance and written self-report, particularly when control was assessed with feedback removed. Implications concerning sources of the subject's knowledge and determinants of discrimination and visceral control are discussed.

(Supported by A0132 from NSERC of Canada)

15a. Shucard, D. W., & Shucard, J. L. (National Jewish Hospital and Research Center, Denver) **AERP waveform comparisons between waking infants and adults.** Recently, auditory event-related potentials (AERPs) have been used to study information processing in infants. Many of these studies have administered complex auditory stimuli to elicit AERPs. However, little information is available about the configuration of the AERP in normal waking infants even with simple stimuli. Previous investigations which have studied the AERP waveform in infants for the purpose of gathering normative data have generally obtained these measures while infants were in various stages of sleep. The findings comparing AERPs from sleeping infants with those from adults have indicated that infants in general produce longer latency responses. The purposes of the present study were: 1) to obtain normative data on the configuration of the AERP waveform in awake infants of different ages, and 2) to compare this waveform with that of adults studied under similar experimental conditions.

Three groups of infants (1-month-olds, 3-month-olds and 6-month-olds) and adults between 20-30 yrs were studied in a quiet, alert state. Subjects were closely monitored via a video TV system and continuous EEG recording. Data were used only from subjects who remained quiet and alert throughout the recording session. AERPs were recorded between T_4–C_z and T_3–C_z to pairs of 600 Hz, 100 msec, 70dB tone pips with an interstimulus interval of 2 sec and an interpair interval of no less than 4 sec.

The findings indicated that: 1) The latencies of *earlier* AERP components in infants were comparable to those reported by other investigators for sleeping infants. For example, Ohlrich and Barnet (1972) found mean latencies for P1, N1 and P2 of 63, 92 and 220 msec, respectively, for 1-month-olds and this study yielded latencies of 72, 102 and 183 msec for this age group. 2) The latencies of *later* AERP components differed considerably from those previously reported for sleeping infants. In the study by Ohlrich and Barnet mean latencies for N2 and P3 of 475 and 678 msec, respectively, were reported for 1-month-olds and in this study latencies of 288 and 393 msec were obtained. 3) The latencies of all components for all infant groups, although somewhat longer, appeared to be much more similar to those obtained for adults than previously reported by other investigators.

(Supported in part by NIMH Grant HD11747)

15b. Thomas, D. G., Shucard, D. W., & Selinger, M. F. (National Jewish Hospital and Research Center, Denver) **Auditory event-related potentials as measures of differential hemispheric processing: Stimulus and cognitive factors.** Recent studies in our laboratory have found that auditory event-related potentials (AERPs) recorded bipolarly over the left and right hemispheres to task-irrelevant tone pips varied in amplitude as a function of task. When the task involved verbal stimuli, left hemisphere AERPs were of larger amplitude. Right hemisphere AERPs were larger when the task involved music. One question arising out of this work is whether differential hemispheric processing is a response to stimulus parameters *per se* or a function of cognitive variables such as task orientation. The purpose of the