Hairiness in Wool in Relation to Blood Potassium Types in Marwari Sheep

The presence of 2 distinct groups of high (HK) and low (LK) potassium types in sheep[1] and subsequent findings about the high adaptability of LK type to desertic conditions[2,3], led us to investigate the differences between these 2 types for wool characteristics. Large differences found between these types with regard to the number of medullated fibres in their wool are reported here.

The experiment was done in 2 trials in which 40 Marwari wethers of 3–4 years of age were used. In the first trial the wool samples from 6 body regions (neck, mid side, britch, wither, shoulder and back) of 10 wethers (5 LK and 5 HK) were examined for medullation during 2 shearing seasons (March and September 1966). In the second trial (March 1967) wool samples from only the britch region of 30 wethers (15 LK and 15 HK) were tested for medullation, as suggested by TURNER et al.[4]. True wool fibres have no medullation whereas hairy fibres are partly or wholly medullated. For examining the occurrence of medullation in a representative sample of fibres from selected body regions, staples from these regions were clipped off and then cut transversely at the tip, middle and the base. The cut samples were mounted on glass slides for projection on a white surface through a microscope using $\times$ 500 magnification. From the number of medullated and non-medullated fibres present in each sample, the percentages of the 2 types were calculated. As many as 100 fibres were tested for each sample.

Results of the first trial have shown that samples from neck, mid side, britch, shoulder, wither and back regions from LK animals had 14.0, 2.6, 20.1, 19.7, 3.9 and 10.5% less the number of medullated fibres during March 1966 and 16.6, 20.5, 26.0, 25.7, 17.9 and 14.9% less for the corresponding areas during September 1966 in comparison to similar samples from HK animals. On the average, LK animals showed 16% fewer medullated fibres than HK for the 2 shearing seasons. Statistical analysis of data, in which the mean percentage of the 6 regions on each animal was transformed into arcsin percentage, showed that the differences between the 2 potassium types for medullation were highly significant ($P < 0.01$). In the second trial, the LK animals showed 22.3% fewer medullated fibres than HK. The difference between LK and HK was found to be highly significant ($P < 0.01$), and this, therefore, confirmed the results of the first trial.

Blood potassium types in sheep are controlled by a single Mendelian gene, HK being recessive[5]. Since LK animals are both heterozygous and homozygous whereas HK are only homozygous recessive, homozygous LK should have fewer medullated fibres in the wool than the combined stock of heterozygous and homozygous used in this study. Therefore, the breeding of LK sheep and subsequent culling of HK segregating from LK $\times$ LK mating in each generation should result in raising flocks yielding true wool fibres. These results, therefore, may have immediate application for the rapid improvement of wool in most developing countries where sheep are largely of hairy type.

Zusammenfassung. Schafe mit geringem Kaliumgehalt im Blut haben an mehreren Körperstellen weniger markhaltige Haare als Tiere mit höherem K-Gehalt.

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[1] G. C. TANEJA and P. K. GHOSH, Ind. J. exp. Biol. *3*, 166 (1965).
[2] G. C. TANEJA, Experientia *23*, 645 (1967).
[3] G. C. TANEJA, B. M. FULADI and R. K. ABICHANDANI, Ind. J. exp. Biol. *4*, 125 (1967).
[4] HELEN NEWTON TURNER, R. H. HAYMAN, J. H. RICHES, N. F. ROBERT and L. T. WILSON, C.S.I.R.O. Divisional Rep. No. *4* (1953).
[5] G. C. TANEJA, Experientia *23*, 273 (1967).

Evoked Responses and Neuronal Activity in the Lateral Geniculate[1]

Many studies of central sensory processes have been based on recordings of the gross evoked response. Since sensory information is carried by neuronal elements and since the relations between the gross response and the neuronal response are poorly understood, some doubts have been expressed with regard to the value of the gross response as an indicator of meaningful sensory input. Recent studies of the visual evoked response have indicated the existence of some relations between the gross and neuronal responses[2–5], but our knowledge of the nature of these relations remains incomplete. The purpose of the investigations described in this report has been to determine the time and phase relations between the gross and neuronal responses, in the lateral geniculate body.

Materials and methods. Multiple microelectrodes made of platinum-iridium wire, sharpened electrolitically to diameters of from 1–5 μ and insulated with glass[6], were stereotaxically implanted in the brain of cats, under barbiturate anesthesia. In some animals, the experiments were conducted under barbiturate anesthesia. Other animals were allowed to recover, were maintained for periods of 2–8 weeks, and the neuronal activity was studied in wakefulness, in the unanesthetized, unrestrained state.

The technique for the simultaneous implantation of several microelectrodes was described elsewhere[7]. Only

[1] Aided by grants Nos. NB 07145 and FO5 TW 1017 from the National Institutes of Health.
[2] S. S. FOX and J. H. O'BRIEN, Science *147*, 888 (1965).
[3] M. LAUFER and M. VERZEANO, Vision Res. Oxford *7*, 215 (1967).
[4] E. R. JOHN and P. P. MORGADES, in press.
[5] M. VERZEANO, P. GROVES and J. THOMAS, Biophys. J. *8*, A-152 (1968).
[6] M. L. WOLBARSHT, E. F. MACNICHOL JR. and H. G. WAGNER, Science *132*, 1309 (1960).
[7] J. THOMAS, P. GROVES and M. VERZEANO, Experientia *24*, 360 (1968).

the stimulating, recording and computing devices will be mentioned here.

Stimulation was performed with brief flashes of light generated by a 'Grass' photostimulator. The flash producing element was set 2 feet from the animal's eyes. All stimulation was conducted in darkness. The neuronal spikes were recorded through special amplifiers with adequate input impedance and low grid current[8]; by using appropriate filtering circuits, it was possible to separate, when desired, the gross and the neuronal responses. The output of the amplifiers was recorded on magnetic tape and pertinent data were analysed subsequently. Permanent tracings, on paper, were made by means of a 'Honeywell Visicorder' oscillograph. Each microelectrode could detect the activity of several neurons or groups of neurons and, accordingly, recorded spike discharges of several amplitudes. The different amplitudes were separated by means of a pulse height analyzer[9] and their number and distribution gave, at any time after the stimulus, an indication of the number of active neurons and the distribution of neuronal activity within the territory surveyed by the microelectrodes (Figure 1). The average gross evoked response, its average first derivative (the rate of change of amplitude with respect to time), the time histogram (the probability of occurrence) and the frequency of discharge (spikes/unit time) of the neuronal response, in one or several amplitude categories, were obtained by means of digital and analog computers. Location of recording points was checked by brain section and histologic examination.

Results. The results indicate that there are definite relations, in time and in phase, between the gross evoked response and the accompanying neuronal activity. The majority of the neurons in the territory surveyed by the

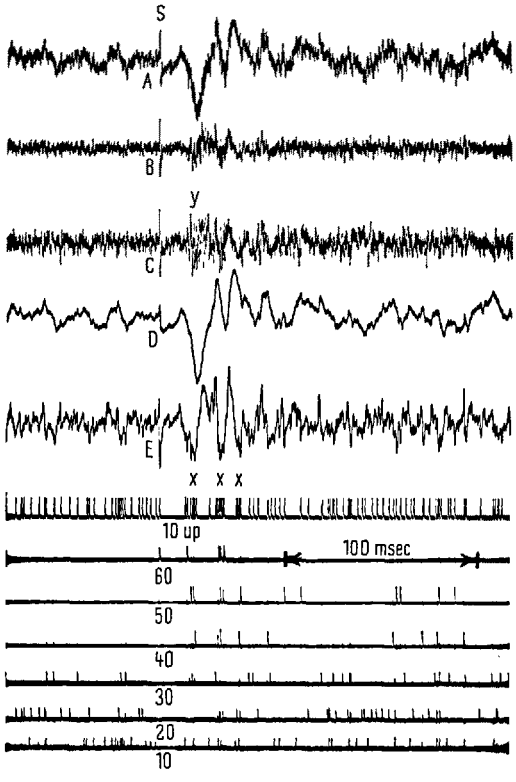

Fig. 1. Original recordings of evoked responses, obtained, simultaneously, by means of 3 microelectrodes (A, B, C), from the lateral geniculate body of the unanesthetized, unrestrained cat, by stimulation with brief flashes of light (S). Microelectrode A records both the gross evoked response and the neuronal response; microelectrodes B and C record only the neuronal response. Tracing D shows the same evoked response as A, after the neuronal spikes have been filtered out and only the gross response remains. Tracing E shows the first derivative (dV/dt) of D, obtained by means of an analog computer. The tracings 10–60 represent the 6 ranges of amplitude into which the spikes shown in tracing A have been distributed by the pulse height analyzer: 10 = 10–20 μV; 20 = 20–30 μV etc., 10 up = all the spikes above 10 μV, lumped together. The points marked 'X' show the increased neuronal discharge on line '10 up', corresponding to the negative peaks of dV/dt, on tracing E. During the first 50–70 msec of the response, neuronal spikes appear in all amplitude ranges, indicating neuronal activity in the whole territory surveyed by microelectrode A. After that time, spikes appear mostly in the lower amplitude ranges, indicating that activity occurs at a longer distance from the tip of microelectrode A. Distance between microelectrodes: A–B = 230 μ, B–C = 230 μ.

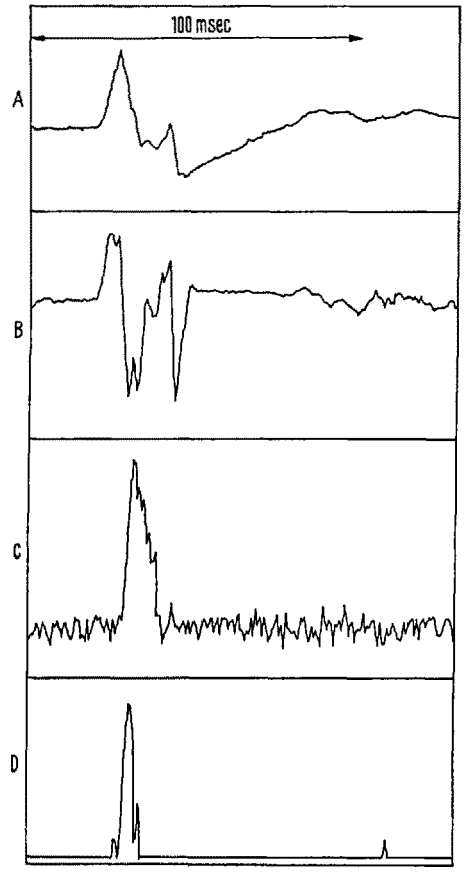

Fig. 2. Relations between gross evoked response and the response of a single neuron. Average evoked response (A), its average first derivative (B), average frequency of discharge of a single neuron (C) and time histogram of the spikes in the discharge (D) obtained, from 158 responses, by means of digital and analog computers and printed by an X-Y plotter. Note that the highest average frequency of discharge and the greatest probability of occurrence of neuronal spikes correspond to the highest negative peak of the average first derivative (the steepest negative slope) of the average gross response.

[8] M. Verzeano and K. Negishi, J. gen. Physiol. *43*, 177 (1960).
[9] M. Verzeano, M. Laufer, P. Spear and S. McDonald, Actual. Neurophysiol. *6*, 223 (1965).

microelectrode, including those which are closest to its tip, discharge in 2–3 successive bursts, within 60–70 msec after the stimulus. The probability of occurrence of neuronal discharge is maximum at the times which correspond to the highest negative values of the first derivative (the steepest negative slopes) of the gross response. This is illustrated in Figure 1. Tracing D shows a single gross evoked response, obtained from an unanesthetized, unrestrained, animal, and tracing E shows its first derivative. The tracing marked '10 up' shows all the spikes in the corresponding neuronal response, whose amplitude was above 10 μV. At the points marked 'X', it can be seen that the highest concentration of spikes corresponds to the negative peaks of the first derivative of the gross response. In the later part of the response, from 70 to 125 msec after the stimulus, much of the neuronal discharge occurs further away from the tip of the microelectrode (tracings 10, 20, 30), and the correspondence between the highest probability of discharge and the negative slopes of the gross response is not as consistent as it is in the early part of the response.

Discussion. A question arises as to whether the concentration of neuronal spikes, at the times which correspond to the steepest negative slopes of the gross response, is due to an increase in the number of neurons discharging at those times or to an increase in the frequency of discharge of the neurons involved, or to both. By separating the spikes according to amplitude it can be seen (Figure 1) that, during the times at which the negative slope in the gross response is steepest, a higher concentration of spikes occurs in all amplitude ranges, indicating that more neurons are active at those times. When the activity of a single neuron is studied it is found that both the probability of discharge as well as the frequency of discharge of that particular neuron, are greatest at the times which correspond to the steepest negative slope of the gross response. This is shown in Figure 2, in which A is the average gross evoked response, B is its first derivative and C and D are the frequency of discharge and the time histogram corresponding to the activity of a single neuron in the neuronal response. For this single neuron, the greatest probability of discharge as well as the highest frequency of discharge occur at the times at which the negative peaks of the first derivative of the gross response are highest.

It can therefore be concluded that, in the early part of the response, both the number of active neurons and their frequency of discharge are highest when the negative slope of the gross response is steepest[10].

Résumé. Il a paru intéressant de préciser les relations de temps et de phase entre la réponse évoquée massive et la réponse des neurones du corps genouillé latéral. Des microéléctrodes ont été implantées dans le corps genouillé latéral du chat et des réponses ont été évoquées par stimulation visuelle. On a pu démontrer que la probabilité aussi bien que la fréquence de la décharge neuronique varient en raison de la première dérivée de la réponse massive à ondes lentes.

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30 January 1968.

[10] It is a pleasure to acknowledge the assistance of Mr. S. BRAKEL in the construction of electronic equipment and of Miss HELEN CHUML in the preparation of histologic materials.

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Selective Blockade by Mephentermine of Reserpine-Induced Serotonin Depletion

Previous reports have shown that the concurrent administration of reserpine (1 mg/kg) and mephentermine (1 mg/kg) produces behavioral excitation in rabbits and dogs[1,2]. The excitation produced in rabbits lasts about 30 min[1]. No stimulation occurs when either drug is given separately. The pharmacological data indicate the stimulation induced by the drug combination is central in origin and depends on the presence of brain biogenic amines[1].

The present biochemical study was undertaken to determine whether mephentermine might hasten the release by reserpine of brain norepinephrine and serotonin, thereby, increasing the concentration of 'free' neurohumor that may excite neurons. The results were unexpected and suggest that the excitation caused by the combined administration of reserpine and mephentermine is produced by the selective release of brain norepinephrine. To our knowledge, this is the first demonstration that a sympathomimetic amine will inhibit the release of brain serotonin caused by reserpine and leave unaffected the release of brain norepinephrine.

In this study behavioral excitation was produced in rabbits by giving i.v. 1 mg/kg of reserpine phosphate followed 7 min later by 1 mg/kg of mephentermine (Wyamine). One group of rabbits was sacrificed 20 min after the drug combination. These animals were hyperactive. A second group was killed 40 min after the injections; these rabbits were previously hyperactive, but were calm at the time of sacrifice. A third group of rabbits was pretreated with 100 mg/kg of iproniazid 24 and 2 h before the drug combination (reserpine and mephentermine) was given and sacrificed 1 h after the drug combination; these animals were hyperactive throughout the period of observation. Iproniazid alone does not cause hyperactivity, but it is known to prolong the stimulation studied herein[1].

Control experiments consisted of the following: one group of rabbits was given 2 injections of saline, a second group was given reserpine and saline, and the third group was administered saline and mephentermine. The injections were given 7 min apart and the animals killed 20 and 40 min after the 2 injections (Figures 1 and 2) by a

[1] R. P. WHITE, D. P. COBB, G. R. BREESE and C. B. NASH, Int. J. Neuropharmac. *5*, 143 (1966).

[2] R. P. WHITE, Archs int. Pharmacodyn. Thér. *164*, 133 (1966).