The amount of water vapor collected on the flight corresponds to a mixing ratio of 0.32 g/kg. This value is slightly less than a value for a corresponding altitude taken from an extrapolation of the 27 June 1960 curve of Mastenbrook (*2*). This curve was chosen since it includes Barclay's point and Mastenbrook feels it is the most reliable one available at the present time (*2, 6*). An attempt was made to keep the water vapor contamination to a minimum. However, because of various possible sources of contamination, the value of 0.32 g/kg is presented only as a maximum value for the altitude.

Although at present only one flight has been made with this equipment, other flights are anticipated.

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20 July 1962

Neuroepithelial Component of the Urethra and Urogenital Junction of the Rat

Abstract. Specialized cells in the epithelium react for cholinesterases when tested by the Koelle thiocholine method. Their morphology and contiguity with cholinesterase-positive nerves suggests receptor function. Impulses originating from them might relate to sensations or muscular reflexes involved in micturition and ejaculation, or both. If they are effector units, special secretory, excretory, or absorptive functions are indicated for cells of probable neural origin.

During a study of the histochemical distribution of cholinesterase in the urogenital organs of the male rat (*1*), certain reactive cells were observed in the epithelium of the urogenital junction and urethra. Similar cells do not appear to have been recognized or described by previous investigators, who used histological or histochemical methods. Because of the apparently unique nature of these cells, it is desirable to record their occurrence and to consider briefly their probable significance.

Formol-saline fixed and frozen sections (30 to 40 μ) of the urogenital junction, including the urethra, neck of the urinary bladder, and adjacent reproductive ducts and glands of the white rat, were prepared. They were then treated for the demonstration of cholinesterase localization by the thiocholine methods of Koelle and Friedenwald (*2*) and Koelle (*3*). Appropriate inhibitors of the reaction served as controls. Both acetylthiocholine and butyrylthiocholine substrates at *p*H 5.6 give positive reactions with 1 hour of incubation; best results occur when the former is used.

According to Koelle (*3*), Dumont (*4*), and Gerebtoff (*5*), the epithelium of the urinary bladder is negative for cholinesterase, but abundant cholinesterase-positive nerves and ganglion cells are present. These workers do not refer to the reactive cells considered here. Gerebtzoff did not observe them in the guinea-pig urethra, and we have not seen them in the mouse (*Peromyscus*). The rat, therefore, may be a special case. Investigators of the innervation of the urinary bladder and urethra [Langworthy and Murphy (*6*), Watanabe (*7*), Ojima (*8*), and Mori (*9*)] who used traditional silver or intravitam methylene blue methods do not mention these cells. No reference is made by Stöhr to the occurrence of neuroepithelial end-organs in this region (*10*).

The epithelium of the urinary bladder, ureters, and the tapering neck region is entirely negative with either substrate used. However, where the walls begin to fold longitudinally, individual flask-shaped cells that react positively make their appearance among the negative epithelial elements (Fig. 1). The cells are uniformly stained throughout their cytoplasm, and their shape is distinctive. They may have a length of 35 to 40 μ. Round or oval nuclei occupy the thickest part of the cells near the basement membrane. A narrow process extends from the cell-body to the inner surface of the epithelial layer and terminates in a distinct pit or notch. The ends of the processes occur at about 15-μ intervals at the surface of the epithelium. Occasional cells appear to be slightly branched, and two terminations may be present. At the basal end of each cell an expanded fan-like expansion or process retains an attachment or contact with the underlying positive nerve network that is present abundantly about the urogenital junction. It is not difficult to detect the contact (synaptic?) between the cells and the nerve plexus, and clear evidence of an anatomical relationship is observable. On this basis, we conclude that the reactive cells represent a sensory or motor element of some type and that they probably are derived from the Schwann cell elements of the nerve plexus.

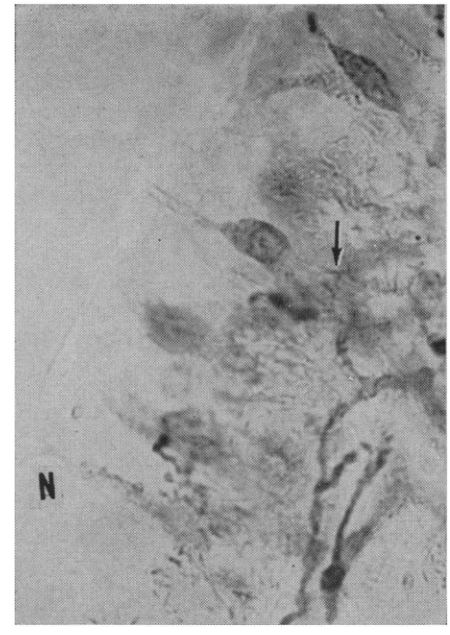

Fig. 1. Longitudinal section (40 μ) of male rat urethral epithelium and submucosa. Acetylthiocholine, Koelle method (× 750). Two reactive cells in sharp focus above the center are in the epithelium. Note basal expansion toward nerve at arrow; notch (*N*) indicates termination of another cell from a deeper focal plane; nerves at lower right.

The cells are distributed at more or less regular intervals, about three to four cell-body diameters apart, and they occur throughout the proximal urethra for a distance of about 7.5 mm. In males, they occur in the prostatic urethra and can be traced into the narrow prostatic ducts, the terminal ejaculatory ducts, and vesicular ducts. None have been found in the vasa deferentia where the epithelium is enzyme-positive (*11*). In females they are structurally similar to those in the male but are limited to the urethral folds. They are present in 18-day-old fetuses.

The shape and orientation of the cells call to mind the classical descriptions of simple unicellular receptors found in the integument of invertebrates and lower vertebrates, and commonly recognized as chemoreceptors. In the urethra, the presence of urine or other materials, such as semen or some seminal component in males, could provide either chemical or pressure stimuli. Thus the cells might be receptors generating afferent impulses leading to sensations,

such as mild burning, light pain, or fullness, associated with urination or ejaculation. It is equally possible that such afferent impulses may be of significance in relation to micturition and ejaculatory reflexes. In males, the presence of specialized receptors in the prostatic region is of considerable interest since these receptors perhaps could serve to coordinate the seminal emission and ejaculatory mechanisms. Since this would not apply in females, perhaps reflexes relating to emptying the urethral contents might be involved.

However, since the cells also resemble some long-necked "goblet" cells, it is also reasonable to regard the epithelial cells under consideration as possibly serving some effector function, such as the selective elimination of some product of nerve metabolism, the release of some secretory product, or the performance of special resorptive duties relating to the nerves. It is of some importance to speculate upon these possibilities, but the mere description of the cells and their regional location justifies only mentioning them as useful clues for further investigation.

This discussion of the possible functional significance of the described neuroepithelial cells presents numerous problems that are yet subject to further study and clarification. The newly demonstrated cells are characterized by their positive reaction for cholinesterases, their typical unicellular neuroepithelial morphology, their anatomical relations to the pelvic nerve plexus, and their internal regional localization in the urethra and urogenital junction (*12*).

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19 February 1962

Eye Movements during Active and Passive Dreams

Abstract. Independent confirmation is offered that the amount of rapid eye movement during dreaming is associated with the dream content.

It is now recognized that there exist two different and alternating categories of sleep. One has been called "hindbrain sleep" by Jouvet (*1*) and is accompanied by a low-voltage and fairly fast electroencephalographic (EEG) pattern, relaxation of certain neck muscles in cat (*1*) and human (*2*) and, perhaps most strikingly, by bursts of conjugate, rapid eye movements with subsequent recall by the subject that he has dreamed (*3*). Dement and Wolpert (*4*) reported evidence supporting their hypothesis that these eye movements were directional responses to the events of the dream. Yet rapid eye movements persist in cats after decortication (*1*). Also the fact that characteristic saw-toothed electroencephalographic waves tend to precede each burst of rapid eye movements appeared to us to cast doubt on the hypothesis; the presence or absence of these eye movements during "hindbrain sleep" of blind men, according to the retention or absence, respectively, of visual imagery (*5*), would support the hypothesis. One of us (*6*) has criticized Dement and Wolpert's report but is now pleased to report confirmation of one of their findings, namely a relation between profuse eye activity and an active dream fantasy.

One of us (R.J.B.), for an entirely distinct purpose, awakened eight volunteers from periods of rapid eye movement on 103 occasions during 37 nights. Dream recall occurred in 89 instances and was recorded on magnetic tape. The dream reports were subsequently all presented to the other of us (I.O.), who had never been present during the nocturnal recording sessions and who had never seen the relevant electroencephalographic or eye movement records. He classified the dream reports as "active" or "passive" according to the nature of the events described, and especially if he felt such events would have been accompanied by many shifts of gaze, had they occurred in real life.

Subsequently R.J.B. assigned code numbers to each electroencephalographic and eye movement record and presented each to I.O., who was entirely ignorant of the dream to which each record was related and distinctly skeptical of the likelihood of the association eventually found. The eye movement periods were classified by I.O. as "active" or "passive" according to the frequency and size of the eye movements which occurred throughout each 10 to 20 minute period prior to the time the subjects had been awakened, although the later in the period the movements did or did not occur, the greater the weight he attached. The whole set of records was then inspected again in a different order by I.O. and classified a second time. R.J.B. then selected the records of the 22 instances where divergent judgments had been made, and I.O. made a final classification of these periods of rapid eye movement.

The code was then broken. Fifty dream reports had been classified as "active" and in 42 instances the relevant period of rapid eye movement had been judged "active." Thirty-nine reports had been classified as "passive" and in 23 instances the relevant period was judged "passive."

It is therefore confirmed that there is a significant association ($\chi^2 = 16.18$; $P < .001$) between the nature of the dream content and the amount of movement of the eyes.

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* Medical Research Council Grantee.

13 July 1962

Antarctic Peninsula Traverse

A 1700-km oversnow traverse was conducted in the Antarctic area south of the Bellingshausen Sea and George VI Sound from 30 November 1961 through 5 February 1962 for the purposes of (i) investigating the surface and bedrock topography by geophysical means and (ii) performing associated geophysical, geological, and glaciological studies (*1*). The route is shown in Fig. 1. Since the area covered was about 2600 km from the main United States base at McMurdo Sound, logistic support proved very difficult, but was capably carried out by the U.S. Navy and Air Force. The party traveled in