

GENETICS

Genetic Studies with *Klebsiella pneumoniae*

GENETIC recombination following conjugation and phage transduction has been reported within and between several groups of enteric bacteria. It was decided, therefore, to look for evidence of genetic exchange in *Klebsiella pneumoniae*, and between this organism and others of the Enterobacteriaceae.

By means of the penicillin selection technique stable auxotrophic mutants were obtained in 17 *K. pneumoniae* strains. Strain NCTC 8821 readily yielded unstable auxotrophs with high rates of reversion to prototrophy, and may perhaps carry a mutation factor like that described by Jyssum¹ in strains of *Escherichia coli*. Strain 8821 did not, however, have a high rate of spontaneous mutation to streptomycin indifference.

Attempted transductions, employing 11 *Klebsiella* phages isolated from pooled sewage, gave only one suggestive result: a cysteine auxotroph of strain NCTC 8172 was apparently transduced to prototrophy at low frequency. The possibility that the rare prototrophs resulted, however, from transformations by deoxyribonucleic acid present in the crude phage lysate has not been excluded.

Mixed cultivation experiments were carried out according to the method of Miyake and Demerec². These failed to yield any evidence of genetic recombination, occurring at the rate of at least 1 recombinant per 10⁷ cells plated, between the different *K. pneumoniae* strains, between *K. pneumoniae* and *E. coli* K-12, HfrH, or *K. pneumoniae* and strain NCTC 8706 of *Chromobacterium prodigiosum*.

An interesting syntrophic interaction was found between an unclassified auxotroph of *C. prodigiosum* 8706 and some *K. pneumoniae* auxotrophs. When well-washed cells of the *C. prodigiosum* mutant were spread on minimal *A* agar³ plates, then incubated at 30°, few prototrophic revertant colonies appeared. Numerous reversions arose, however, if this auxotroph were incubated on minimal medium supplemented with a small amount of broth, or if washed mixtures of the *C. prodigiosum* and *K. pneumoniae* auxotrophs were incubated on minimal medium.

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¹ Jyssum, K., *Acta Path. Microbiol. Scand.*, **48**, 113 (1960).

² Miyake, T., and Demerec, M., *Nature*, **183**, 1586 (1959).

³ Davis, B. D., and Mingioli, E., *J. Bact.*, **60**, 17 (1950).

PSYCHOLOGY

Effects of Mental Activity on Vestibular Nystagmus and the Electroencephalogram

MOWRER¹ noted differences in head nystagmus elicited by rotation under conditions of 'excitement' and 'rest' in pigeons. Wendt² has indicated that "inward-directed reverie states" reduce nystagmus and that the subject must "maintain an environment-

directed orientation" to avoid replacement of nystagmus by wandering, autogenous eye movements. The present work was undertaken to ascertain how nystagmus, produced by a standard vestibular stimulus, is modified by different sets of instructions and, further, to determine the effects of these conditions on the electroencephalogram.

Subjects were seated in a light-proof room in the centre of a rotary apparatus, described in detail by Guedry and Kalter³. An adjustable biteboard held the subject's head in a standard position and a telegraph key, mounted on the right arm rest, was used as a signalling device. An Offner type *T* encephalogram, secured to the table, permitted the simultaneous recording of encephalogram (from a pair of parieto-occipital leads), horizontal nystagmus, subject key presses and a marker which denoted the periods of acceleration and deceleration. Subjects met three criteria: (a) no history of labyrinthine disorder; (b) production of alpha activity when relaxed with eyes closed; (c) quantifiable nystagmus. Of the seven candidates tested, only one was eliminated (due to a lack of alpha production). All subjects had previous turntable experience.

Three tasks were selected: (1) key pressing-signals made by the subject to indicate onset, cessation, and each experience of 90° of subjective rotation; (2) mental arithmetic—subjects were instructed to divide 80 and each successive quotient by 5, ignoring the external environment, and proceeding as rapidly and accurately as possible (answers were recorded); (3) reverie—subjects were told to ignore the environment and simply to relax and daydream without directing their thoughts in any way. The tasks were given in the sequence above and repeated in the same order. The six trials were conducted successively on a single day.

All trials were conducted in the dark with eyes open, head upright, and rotation in a clockwise direction. Each trial began with a 30-second period of rotation at 1 r.p.m. followed by 14.9 sec. of 4.5°/sec.² acceleration to a constant velocity of 12.2 r.p.m. This speed was held for 2 min. before the subject was decelerated at 4.5°/sec.² to 1 r.p.m. After 1 min. of rotation at this velocity, the turntable was stopped and the trial ended. Prior to each trial, subjects alternately fixated markers for calibration purposes. They were located so as to provide horizontal eye sweeps of ±20° to either side of a central fixation point.

The slow-phase amplitude of the nystagmus was measured in centimetres, summed for the 14.9-sec. periods of acceleration and deceleration respectively, and converted to total degrees of slow-phase eye movement. The measurements made were the vertical distances from the peak of each nystagmic beat to the slow-phase base-line of that beat. Durations were calculated from the start of stimulation to the point where the primary nystagmus ended. The data from the encephalogram were tabulated by the 'seconds of alpha' technique, and the scoring covered only the periods of acceleration and deceleration.

Much less nystagmus was present during the daydreaming than during the key pressing or arithmetic trials (Fig. 1). The scored observations were subjected to separate analyses of variance and *t* tests. For acceleration, the conditions did not yield significantly different results. The deceleration results yielded the following significant relationships: (a) smaller total